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DEMOGRAPHY AND VITAL STATISTICS

(REPORT)

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* E	...	... Physically Handicapped of Madras State
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PREFACE

It is the practice of Census to devote considerable attention to vital statistics in General Report. As a numerical record of fertility, mortality, morbidity, marriage etc., vital statistics together with Census data, help us in studying demographic trends. In view of the increasing importance of vital statistics, a separate volume in two parts has been devoted to vital statistics for the first time in the Madras Census history. It has become increasingly clear to all concerned that the registration of vital statistics has to be made more perfect. They define the problems and measure the results of public health work and form the basis of all intelligent programmes.

In this volume, all useful data have been collected and presented to the reader. No doubt birth and death records of our country are not properly maintained. Vital statistics, therefore, suffer from the defects of incomplete recording and faulty compilation. In Chapter II of this volume, an exhaustive note on the accuracy of vital statistics in Madras has been given. An effort has been made to estimate the quantum of under-registration which has always been a feature of our registration system. We have also indicated how a systematic effort can be made to improve the quality of registration.

In Chapters XI and XII, the extent of migration in the State has been studied. Migration has become an important element of population changes at least in Madras State. Our analysis has revealed that migration has played an important part in determining the demographic trends of Madras State. Except for the decade 1941-51, Madras State has generally contributed to an out-migration and Madras population can be considered to be more mobile than in other parts of the country.

An abridged life table for the State has been worked out in Chapter VI which gives an expectancy of life at birth of 39.85 for males and 38.24 for females. A considerable decrease in the death rate has been recorded, particularly after 1921, which has been attributed to the growth of medical and health services. There is a possibility of a further drop in death rate as a result of which life expectancy may go up. The fertility rate has begun showing a declining trend, but it is not as marked as it should be.

A projection of Madras population has been attempted basing it on certain assumptions on fertility, mortality and migration in Chapter XV. It is expected that the population will increase to 37.8 millions in 1971 and 45.3 millions in 1981 if constant fertility is assumed. If a fertility decline is assumed, then the estimated population of the

State for 1971 and 1981 will be 37.6 millions and 42.6 millions respectively. Not much change in fertility has been recorded in the State in the recent past and as such, it is difficult to make any accurate estimate of future changes.

A separate survey on fertility was conducted on a sample basis throughout Madras State. The results of the survey have been used to highlight the prevailing fertility pattern in the State. Nor has family planning made any spectacular impact so as to produce any decline in general fertility rate. A survey on family planning attitudes in Madras City has also revealed that family planning methods have not become as popular as they should be. As such, it will be difficult to assume any great change in the level of birth in the near future. Unless the reduction in death rate is balanced by a reduction in birth rate, we will have to face serious problems in future. As such, there is every need to propagate scientific methods of family planning throughout the State.

In preparing this volume, I have been greatly assisted by Sri K. E. Vaidyanathan, Tabulation Officer whose name I have shown as an associate editor. Sri N. Rama Rao, Tabulation Officer, Sri R. Narayanan, Statistical Assistant and Sri V. Balasubramanian have helped me in getting ready this volume for publication. I am grateful to Messrs Thompson & Company (Private) Limited, Madras, for printing this volume. I should place on record the assistance rendered by the officers of the Government of Madras, especially the Director of Public Health in furnishing all the material needed for preparing this volume.

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DEMOGRAPHY AND VITAL STATISTICS

CHAPTER I

INTRODUCTION

Object of the report

The object of this volume is to study the vital statistics of Madras State with its consequent impact on demographic trends. The importance of proper maintenance of vital statistics containing records of marriage, birth, sickness and health cannot be gainsaid. It is the endeavour of every civilised country to maintain vital statistics as accurately as possible. In India, records of infantile mortality have been maintained and that too with some degree of accuracy. It is the general view of demographers that, in India, maintenance of births and deaths has not been done properly and it is unsafe to rely on them for studying the demographic trends. According to Bhore Committee and the views expressed by the Registrar-General, India and the Superintendents of Census Operations in the past, birth and death statistics of Madras State have a higher degree of accuracy than any part of India.

Broadly speaking, population changes are governed by the three factors, fertility, mortality and migration. Each of these factor is related to a number of other variables, social, economic and political. For instance, fertility or reproduction is influenced by the age at marriage, the prevailing social customs regarding conjugal relations and taboos associated with widow remarriage. The level of economic development and the standard of living of the people influence the rate of mortality and migration. Therefore our concern in this report is to present all the available facts relating to each of these factors of population change and analyse their impact in bringing about the observed rates of growth.

There are three questions for which we have attempted to find answers:

(*a*) What is the present level of fertility, mortality and migration in the Madras population ?

(*b*) Has there been any change in the levels of these factors in the past ?

(*c*) Are there patterns of variation in the population between different areas, social classes and the like ?

These enquiries have involved the sifting and marshalling of numerous statistical materials which are sometimes deficient and more often conflicting with each other.

Vital Statistics

Traditionally, there are two types of data available for such a study. One is the census count and the other is the system of registration of vital events.

Compared with Census enumeration, systematic registration of vital events in life is a comparatively recent development. In the middle ages, detailed records were available for the propertied classes and the nobility of England and of European Continent. The maintenance of such records was originated in Spain by the Archbishop of Toledo in 1497.

The first London Bills of Mortality were compiled during the reign of Henry the VIII, in 1538. It was John Graunt (1661) who, in his book "Natural and Political Observations......upon the Bills of Mortality" showed how these basic records might be analysed to indicate the prevalence of epidemic and chronic diseases. The technique of Life Table was first developed by Edmund Halley (1687–91). As the "Compiler of Abstracts" in the General Register Office from 1839, it was William Farr who pioneered the proper analysis of the census and registration data. His commentaries on current vital statistics which may be found in the Annual Reports of the Registrar-General were masterly and classical. Farr made an immense contribution to the growth of the death certification system and laid the foundations of scientific classification of causes of deaths.

The collection of vital statistics in the United States was first attempted in connection with the 1850 census, when a schedule was provided to obtain data for each death that occurred within the year preceding the census data. In the subsequent censuses upto 1900, similar steps were taken to obtain death statistics but the data were incomplete and inaccurate. The Federal Government began its annual collection of death statistics in 1900 and birth statistics from 1915. In India, the earliest attempt at registration of vital events was made in Calcutta, Bombay and Madras in 1865 as a result of the recommendations of the Royal Commission

appointed to inquire into the sanitary conditions of military personnel serving in India. Some countries notably the Netherlands, Denmark, Norway, Sweden and Finland maintain a system of continuous registration of population for administrative purposes. The system was started in Sweden as a Church Institution in the 17th Century and has been most successfully developed there. Each community within the country keeps a permanent record of the characteristics of the population which is made uptodate by registration of the changes as they occur.

The development of Vital Statistics as a scientific inquiry owes much to the international organisations and the cooperation between the different statistical agencies. The first International Statistical Congress which met at Brussels in 1853 heralded the establishment of a Permanent Commission of the International Statistical Congress in 1872 and in 1885, an International Statistical Institute was formed.

The first important stage in the history of vital statistics was the establishment in 1923 of a Health Organisation by the League of Nations consisting of an Advisory Council and a Health Section. The second was the formation in 1946 of the World Health Organisation. The third event was the establishment of the Statistical Office of the United Nations which collects population statistics all over the world and publishes annually a Demographic Year Book.

The establishment in India of the Office of the Registrar-General and ex-officio Census Commissioner in the Ministry of Home Affairs was a step intended to improve health statistics. Further, an Epidemiological Cell was established in the Office of Director General of Health Services in 1960 to deal with epidemic intelligence. The Health Survey and Development Committee (Bhore Committee) indicated that in general, vital statistics of India has three main defects :—

(i) incompleteness in the recording of events ;

(ii) inaccuracy in the cause of death ; and

(iii) faulty compilation.

In 1951, Sri R. A. Gopalaswami, the then Census Commissioner of India prepared an elaborate scheme which was considered and approved by the Population Advisory Committee in October, 1951. The main features are as follows :—

(1) There should be a permanent organisation in each State (or group of States) to deal with population statistics including vital statistics and census in charge of a Superintendent of Census Operations and ex-officio Director of Population Records. The cost of the organisation should be shared equally by the Centre and States ;

(2) The National Register of Citizens prepared from the enumeration slips at the time of the last census be regularly maintained along with the Register of Births and Register of Deaths and these two registers should constitute the principal population records ;

(3) An annual review of population records be carried out in order to bring to light as large a proportion of omissions in registration as possible ;

(4) The National Register of Citizens be revised simultaneously with the Electoral Rolls where house-to-house visits and enquiries are carried out for revising the latter ;

(5) An Annual Sample Census be held in conjunction with the Annual Revision of Population Records ;

(6) An Annual Population Report be prepared for each State ;

(7) Improvement be made in the system of area under registration, registration staff, forms, compilation, etc.

The establishment of the Office of the Registrar-General has enabled the compilation of vital statistics at the All-India level and brought about certain uniform procedures and standards. The Registrar-General has brought out an annual publication entitled Vital Statistics of India for 1960–1961 and 1962 which gives a general background of the registration of births and deaths in India.

It is not possible practically to achieve a cent per cent accuracy of the registration of births and deaths whatever be the machinery employed. The colossal amount of work involved in compiling statistics from more than 20,000 units month by month and consolidating them is a difficult task. The agency employed is not intended to do this work alone, nor is it possible to visualise the agency with necessary coverage, experience and skill which can do this work properly. Madras has built up a system of revenue administration for more than a century. This machinery has been entrusted with the duty of recording births and deaths and the data have been compiled by a somewhat experienced staff of the Director of Public Health. Whatever be the accuracy of the return, it stands to reason to presume that reasonable figures can be obtained for a comparative study of the birth and death figures from decade to decade.

In this volume, an attempt will be made to study the registration of vital statistics in Madras State. The limitation of the data will be discussed and will be kept

in mind while drawing inferences. Our main concern is the study of fertility and mortality and the demographic trends in Madras but statistics relating to morbidity and health have also been included.

It will, however, be of interest to have a historical background of the system of births and deaths in Madras State and the views expressed by the successive Superintendents of Census Operations on the reliability of the data.

Registration in Madras State

A chronology of important events in the development of the vital registration system is presented in Table 1—1.

TABLE 1-1

Chronology of important events in the development of the vital statistics system in Madras State

1855 ... Death Registration was first attempted in Madras town only.

1863 ... The Royal Commission which investigated into the health conditions in the British areas in India drew attention to the inadequacy of vital statistics for the Presidencies.

1864 ... In pursuance of the recommendations of the Royal Commission, Sanitary Commissions were appointed in Madras, Bengal and Bombay in April 1864. This was the beginning of the Public Health Department of Madras State.

1865 ... Attempt was made to register mortality in the Madras Presidency through the agency of the Sanitary Department.

1899 ... The Madras Registration of Births and Deaths Act made registration of births and deaths compulsory in areas covered by this Act. Registrars of Births and Deaths were appointed for the first time. The father or any adult male member of the house or the midwife assisting at the birth or death was expected to report the birth within 2 weeks and death within 4 days of its occurrence to the Registrar of Births and Deaths. In case of births and deaths occurring in a hospital, the medical officer in charge was required to send a notice to the Registrar. Failure to notify births and deaths made the responsible party liable to a fine not exceeding rupees ten.

1919 ... The Madras City Municipal Act. The Commissioner of the Corporation of Madras was authorised to divide Madras City into districts of registration and appoint a person as Registrar of Births and Deaths within each such district.

1920 ... The District Municipalities Act required municipalities to register all births and deaths occurring in the municipalities. The Municipal Councils were also empowered to make by-laws for verification of deaths and causes of death, for registration of births, deaths and marriages and for enumeration of inhabitants of the City not inconsistent with the Act. Births were required to be registered within one week and deaths within 36 hours.

Information regarding municipalities was included within the purview of the weekly returns of Vital Statistics published in the *Fort St. George Gazette*. (G. O. No. 99-L, dated 30th January, 1920).

1926 ... Government required the Health staff to furnish full particulars to the Tahsildars to facilitate such action (G.O. No. 1387, P.H., dated 10th August, 1926).

1932 ... The compilation of Vital Statistics for non-municipal areas was standardised. Three principal forms were prescribed : (i) Monthly Posting Register of Births and Deaths ; (ii) Monthly consolidated statement of births and deaths in the non-municipal areas of the district, (iii) Monthly consolidated statements of births and deaths in the Rural towns with a population of 5,000 and over. (G.O. No. 1013, P.H., dated the 12th May, 1932).

1933 ... Compilation of Vital Statistics was centralised in the Office of the Director of Public Health. A statistical unit with one Statistical Assistant and 11 clerks was created.

1939 ... The Board of Revenue passed a resolution directing the Taluk Head Accountants responsible for the safe custody of births and deaths registers.

1941 ... The returns of births and deaths for Municipalities which the Municipal Health Officers were required to submit, were standardised. The causes of death were divided into 12 groups covering 45 causes and 12 other individual diseases. (G.O. No. 3051, P.H., dated the 17th July, 1941).

1945 ... Madras Registration of Births and Deaths Act, 1899, was amended to enable the extension of the original act to Plantations.

1946 ... Bhore Committee Recommendations for the improvement of Vital Statistics.

1949 ... Government of India established a permanent Office of the Registrar-General and ex-officio Census Commissioner to co-ordinate the collection and compilation of population and Vital Statistics.

1951 ... Shri R. A. Gopalaswami's Scheme for the improvement of Vital Statistics was released.

1952 ... The Sample Census of Births and Deaths was undertaken in the State by Superintendent of Census Operations.

1961 ... The Vital Statistics conference held in April 1961 at New Delhi made many important recommendations for the improvement of vital statistics.

The Mudaliar Committee Report was released. The major recommendations are (1) that the Secretary of the Gram Panchayat should be appointed the Registrar of Births and Deaths and that the returns should be submitted to the District Office through the Block Office ; (2) that arrangements should be made for the peripheral reporting officials to mail birth and death data in unstamped cards ; (3) that the certificate of births should be insisted upon at the time of admissions to schools and colleges ; (4) that the power of prosecution of offenders should vest with the District Health Officers and not with Tahsildars.

1962 ... The ad-hoc Census of births and deaths was carried out by the ad-hoc Census Committee set up by the Government. The agency for the ad-hoc Census was the Panchayatdars.

The earliest attempt for the registration of deaths was made in the town of Madras in 1855. This was based on the suggestion made by Mr. E. F. Elliot, Chief Magistrate and Superintendent of Police in 1853 and the procedure laid down by the Medical Board. In 1859, the British Government deputed a Royal Commission to enquire into the sanitary conditions of cantonments in India. In 1863 this Commission submitted its report which among other things urged the introduction of a scheme for registration of birth and death statistics. The Board of Revenue and the Sanitary Commission took up the matter further and in 1865, the Government of Madras ordered the registration of deaths and three years later the Government ordered the registration of births also.

Village authorities charged with the duty of registration were furnished with registers, with instructions to forward copies monthly, to the Revenue Inspector. Registration circles were formed. It was considered that the returns should be prepared separately for towns having more than 5,000 inhabitants and for municipal towns. The jurisdiction of a Revenue Inspector was constituted into a Revenue Circle. Thus, the returns from revenue circles, municipal towns and two or more towns in each taluk having more than 5,000 inhabitants, were aggregated into the taluk return. The returns from all taluks were aggregated into the district return. The returns from the taluks were collected by the Deputy Collector and forwarded to the Civil Surgeon, for tabulation of the district returns and transmission to the Sanitary Commissioner. Zamindary tracts were excluded, as there was no agency available, by which the scheme could be worked in those tracts. The returns were submitted every month and the Sanitary Commissioner prepared both the monthly and annual returns. These proposals were contained in an order issued by the Government in August, 1869.

Acts concerning registration of births and deaths

The earliest attempt to impose a statutory obligation on the citizens to report births and deaths was made in 1867 in Madras town only, with the enactment of the Madras Municipality Act, 1867 (Act IX of 1867). This Act was amended and reissued in 1878, 1904 and 1919. The registration of vital statistics was made compulsory in municipalities by legislation, by the enactment of the Madras District Municipalities Act, 1884. This Act was reissued as the Madras District Municipalities Act, 1920 (Act V of 1920). The Madras Registration of Births and Deaths Act, 1899 (Act III of 1899), extended compulsory registration to rural tracts also. Section 2 of the Act empowers the State

Government to extend the Act, or any portion thereof, by notification, to any local area beyond the limits of the City of Madras, and all the municipalities constituted under the Madras District Municipalities Act, 1884, and also to exclude by notification, any such local area from the operation of the Act, or any portion thereof. Till 1940, the Act was in force throughout the district of Chingleput and practically in the entire Coimbatore, Madurai and North Arcot Districts. The Act has since been extended to cover the entire State, except the areas specified in Table 1–2. The population in these areas is less than 0.1 % of the population of the State. In the Cantonment areas the registration of births and deaths is carried on under the provisions of the Cantonments Act (Central Act II of 1924), by the Executive Officer.

TABLE 1-2

List of villages to which the provisions of Madras Registration of Births and Deaths Act of 1899 have not been extended

THANJAVUR DISTRICT

Pattukottai Taluk :

Zamindari :

Puvalur

Inam :

Maruthipatnam
Mogar
Ottangadu Ukkadai
Pukkarambai
Ramachandrapuram
Thittagudi

Arantangi Taluk :

Kattukkudi

TIRUCHIRAPALLI DISTRICT

Musiri Taluk :

Vannadu
Kombai
Thumbaranadu
Rudraksa Kombai
Pongalayee Kombai
Puliyancholai Kombai
Kanathu Kombai
Nallamathi Kombai
Rasan Kombai
Sangampatti Kombai Bit I
Sangampatti Kombai Bit II
Sukkalambatti Kombai

TIRUNELVELI DISTRICT

Tiruchendur Taluk :

Nathakulam (V)

Koilpatti Taluk :

Chidambarapatti
Koppanpatti
Parasurampuram
Olakulam
Achankulam
Kamanaickupatti
Kurivinatham
Melmandai
Periyasamipuram
Sakkamalpuram
Sivagnanapuram (Near Arunkulam)
Sivagnanapuram (Near Kadambur)
Suramgudi
Tharuvaikulam
Thuthampatti
Thuraiyoor
Thotampatti

NILGIRIS DISTRICT

Coonoor Taluk :

Hallimoyar
Kallampalayam

In rural areas where Act III of 1899 is applicable, the father of the child or other adult male member of the family where the child is born should register the birth within two weeks of its occurrence. Similarly, in the case of deaths, the nearest adult male relative present at the death should report within four days after the event. In areas where the Madras District Municipalities Act of 1920 is applicable, the father or mother of a child born or the registered medical practitioner, *vaidyan* or *dai*, who attended the birth should report to the municipality within a week after the day of such birth and in the case of death within thirty-six hours after the death. In Madras City, just as in the other municipal areas, births should be reported within a week and deaths within thirty-six hours after the event.

In Panchayat areas where Act III of 1899 is in force, the village headmen do the work of registration of births and deaths and if the Panchayat consists of more than

one village, then the headman of each village maintains a register relating to his village in the Panchayat. In Cantonment areas, the registration of vital statistics is carried on by the Executive Officer under provisions of the Cantonment Act, 1924 and in Municipal areas, the Municipal Council is expected to register all births and deaths occurring in the municipality, and for this purpose the council may divide the municipality into several districts. Persons possessing the qualifications of Sanitary Inspectors are appointed Registrars of Births and Deaths. Under the City Municipal Act, 1919, the Commissioner of the Corporation of Madras shall divide the City into several districts of registration and appoint a person as the Registrar of Births and Deaths.

Checks and detection of omissions

According to Board Standing Order No. 101 the revenue subordinates are expected to inspect the registers maintained by the village officers and bring to notice any negligence on their part in the registration of births and deaths. Collectors and Divisional Officers are also expected to scrutinise the birth and death records at the time of 'Jamabandi.' Under the Public Health [illegible] improvement [illegible] of the Health Inspector to Code (Vol. I), it is the duty of the Health [illegible] inspect the birth and death registers of the villages he visits and check their completeness and accuracy by house to house enquiry. In Municipalities and Panchayats where Sanitary Inspectors are employed they should help in the work of registration of births and deaths by enquiry during their inspections. In the City of Madras, the outdoor staff of the Health Department, when they come across any omission, bring it to the notice of the Registrars of the district concerned. A synoptic view of the system of registration of births and deaths in Madras State can be had from Appendix I.

Compilation of vital statistics

Each district, taluk and village has been given a location code number to facilitate compilation at the State level. The government have made arrangements for printing forms and their supply to the peripheral agencies.

The forms of the register of births and deaths prescribed for the rural areas, towns and municipalities and the City of Madras under the rules framed under the respective Acts are different. A copy of the form used for registration of births and deaths under this Act is given in Appendices II and III. The Birth Registration Form included items such as dates of birth, and registration, sex of the child, its nationality and caste name if any, father's and mother's names, number of the live birth, residence and the particulars regarding the informant. Likewise the registration return for death has provision for dates of death and registration, names of parents, residence at the time of death, age, sex, nationality and caste, of declared cause of death and particulars regarding the informant.

The Birth and Death Registration Forms in use in Municipalities under the Madras District Municipalities Act, 1920 are given in Appendices IV and V. The Birth registration form contains a few items like occupation of father or mother, relationship of informant, the name of child and details about the midwife or doctor who attended the birth. The death register for municipality is less elaborate than the one for non-municipal areas.

The forms for births and deaths in use in Madras City under the Madras City Municipal Act, 1919 are furnished in Appendices VI and VII. In the municipal return there is no provision for cause of death whereas the return for Madras City has provision for cause of death as well as the duration of illness, if any.

Under rule 3 of the rules framed under the Madras Registration of Births and Deaths Act, 1899, the Registrar shall submit the monthly returns to the Tahsildar on or before the third day of each month, [illegible] an abstract of the entries in the registers of births and deaths relating to the immediately preceding month. The monthly abstract is prepared according to the date of registration of the events. The Tahsildar collects all the birth and death returns relating to the villages in his jurisdiction and forwards them direct to the Director of Public Health by the 8th of the succeeding month. The monthly returns consist of two parts one relating to births and the other relating to deaths.

Under Rule 12 of the rules framed under the Madras District Municipalities Act, 1920, the executive authority of every municipality shall forward a statement in Form D of the births and deaths registered during each week ending Saturday and each calendar month to the Director of Public Health. In the case of Madras City, the Health Officer shall forward statements in Form E of the births and deaths registered during weeks ending Saturday and in Forms F, G, I and J, all the births and deaths registered during each calendar month to the Director of Public Health. Here again, the monthly returns consist of two parts—one giving the particulars relating to births and the other to deaths on the same pattern, as in the case of non-municipal areas.

The monthly return prescribed in the case of non-municipal areas is simple and contains less information. The monthly return for municipalities is more elaborate

and that of the City of Madras still more. In actual practice, the returns are usually in arrears.

At present, monthly returns of births and deaths relating to a village are consolidated by the Village Registrar and forwarded to the Tahsildar. The Tahsildar collects all these returns relating to his taluk and transmits them to the Director of Public Health. From these returns the Director of Public Health compiles monthly and annual statements. Prior to 1932, the statistics relating to a district were compiled in the offices of the Collectors and transmitted to the office of the Director of Public Health. In order to eliminate delay and mistakes in the compilation in the intermediate stage the returns from the villages are now being collected by the Tahsildars and transmitted to the Director of Public Health.

The figure furnished in the weekly returns in respect of municipalities with a population of 30,000 and above are consolidated by the Director of Public Health and the consolidated statement forwarded to the Registrar-General, India. This gives particulars regarding births (live and still), deaths by broad causes of deaths and birth and death rates (*Vide* Appendix VIII).

The figures furnished in the monthly returns from municipalities are consolidated in a form specially prescribed for this purpose (Appendix IX.). The figures of births and deaths as per community and sex are consolidated. In respect of deaths, particulars of causes of deaths are consolidated under the following broad groups: Cholera, Smallpox, Plague, Fevers, Dysentery and Diarrhoea, Respiratory Diseases and deaths from child-birth, injuries and all other causes. As regards ages at death, figures of deaths in age groups are compiled. The age groups under which deaths are classified are as follows: under 1 year (the sub-groups being, under 1 week, over 1 week and under 1 month, 1–6 months, 6–12 months), 1–5 years, 5–10 years, 10–15 years, 15–20 years, 20–30 years, 30–40 years, 40–50 years, 50–60 years and 60+ years. The monthly consolidated statement of births and deaths recorded in the municipalities is published in the *Fort St. George Gazette*.

In addition to the weekly and monthly returns, an annual return of births and deaths in the same form as those used for the week and the month is obtained. The annual figures relating to municipal areas are consolidated and published in the Annual Report of the Director of Public Health.

As in the case of the monthly returns for municipal areas, the monthly returns for villages, (*i.e.*, non-municipal areas) are posted in a special register in the office of the Director of Public Health. (*Vide* Appendix X.) The figures for each taluk and for the district are consolidated by the end of the subsequent month and a copy of the same is sent to the District Health Officer concerned for scrutiny and action where necessary. The monthly figures of births and deaths for the non-municipal areas are then compiled from the consolidated statement, for each district. The statement showing births and deaths recorded in each district and the State is published in the *Fort St. George Gazette*. The Vital Statistics in respect of towns with a population of 10,000 and above although included in the district figures, are separately compiled as indicated in Appendix XI and Vital Statistics relating to each town with a population of 10,000 and above only are published in the Gazette. The annual figures are compiled from these monthly statements and published in the Annual Report of the Director of Public Health.

Publication of the Director of Public Health, Madras

The Director of Public Health, Madras, brings out an annual publication entitled the "Report on Health Conditions in Madras State" containing an analysis of the annual statistics of births and deaths obtained from registration data. This report contains statistics of live-births, still-birth, death by causes and by age at death and also that of vaccination. Birth and death statistics are available for each sex monthwise for the State as a whole. Infant deaths and maternal deaths and their rates are available districtwise for municipal and non-municipal areas. Infant deaths by age groups—under 1 month, one to six months and six to twelve months are furnished for each of the municipalities in the State. For municipalities with a population of 30,000 and above and having Health Officers, data on causes of death are available by age groups. Still-births and Infant deaths by religion are also presented in respect of the municipalities. Deaths by age groups are presented for rural and urban areas of each district separately. Figures of deaths due to Cholera, Small-pox, Plague, Fevers excluding Malaria, Malaria, Dysentery and Diarrhoea and Respiratory Diseases are furnished monthwise for each district.

Morbidity Statistics

As per the provisions of the Madras Public Health Act, 1939, the following diseases occurring in rural and urban areas are notifiable:

(*a*) Cholera
(*b*) Smallpox
(*c*) Chicken-Pox
(*d*) Measles
(*e*) Plague

(*f*) Diphtheria
(*g*) Scarlet Fever
(*h*) Cerebro-spinal Fever
(*i*) Leprosy
(*j*) Rabies
(*k*) Typhus
(*l*) Enteric Fever
(*m*) Yellow Fever
(*n*) Tuberculosis
(*o*) Infective Lupalitis
(*p*) Poliomyelitis
(*q*) Virus Encephalitis and
(*r*) Whooping-cough.

Every medical practitioner who becomes cognizant of the existence of any notified disease, every head of a family and every owner or occupier of a house who knows or has reason to believe that any person in any premises under his management, control or occupation is suffering from or has died of a notified infectious disease, shall give information of the same to the Health Officers or Sanitary Inspectors or the Village Headman. Although there is legal provision for notification of these diseases, this is not actually enforced owing to various reasons, such as lack of adequate laboratory and other facilities for diagnosis of diseases, ignorance of people, etc. However, in respect of the three epidemic diseases of Cholera, Smallpox, and Plague, people are generally familiar with their manifestations, and occurrence of these diseases is reported. Statistics of such occurrences are notified to the village headmen who record them in special registers under departmental instructions. Although it cannot be claimed that reporting is complete, the consolidated figures give a fairly correct picture of the extent and intensity of their prevalence. The village headman sends immediately daily reports of attacks and deaths from these three diseases to the concerned Tahsildar and the Health Inspector at the same time. The Tahsildar in turn sends daily reports to the Director of Public Health, the District Health Officer and other officials. Similarly, the executive authorities of Municipalities send daily reports to the Director of Public Health. The daily reports are consolidated in the Office of the Director of Public Health. Daily bulletins and weekly statements showing attacks and deaths from these diseases are issued to various health officers in the district to apprise them of epidemic situation in this State.

Changes in Registration Area

During the period 1921 to 1960, practically the entire State was covered by registration. However, the Vital Statistics of the State are affected by frequent transfers of areas from one district to another and the territorial adjustments with adjoining States. The changes in the territorial jurisdictions of the different districts of the State during 1921–61 are furnished in Table 1–3. These changes are of little significance when we consider the rates for the State ; even when we calculate the rates for districts, there are only a few that are of any consequence. I felt it is not worthwhile attempting any elaborate adjustments for all the changes since the resultant correction may at best make the rates higher or lower than the unadjusted rates by one or two points. The Director of Health Services, Kerala sent me the Annual Reports of his office and enabled me to compile the Vital Statistics for Kanyakumari District. The population of Tiruchirapalli District was adjusted upto 1948 to account for the absence of Pudukkottai and the Vital Statistics of Coimbatore District was adjusted to account for the transfer of Kollegal to Mysore in 1956. Likewise, the figures of Vital Statistics for Tirunelveli District were adjusted for inclusion of the Shencottah Taluk. These adjustments were carried out only for the main tables relating to Birth, Death and Infant Mortality and the deaths from Cholera, Smallpox and Plague. For the detailed tables, cross classifying these by age, sex and religion has not been attempted. The villages which are not covered by Act III of 1899 at the end of 1961 are already indicated in Table 1–2. Even in these villages, registration is carried out by the executive orders of the Collectors. The present position is that Madras has registration throughout the State and if no further territorial changes occur, we will be having a continuous and comparable series of Vital Statistics from 1921.

TABLE 1–3

Changes in territorial jurisdiction of districts of Madras State, 1921-61

1.	*Madras*	...	In 1950, Saidapet Municipality and suburbs were added from Chingleput District.
2.	*Chingleput*	...	In 1950, Saidapet Municipality and suburbs were transferred to Madras City and about 11 sq. miles were transferred to Nellore District.
			In 1960, the Tiruttani Taluk was added from Andhra Pradesh due to Pataskar Award.
3.	*North Arcot*	...	In 1921–30, Kuppam area (305 sq. miles) was transferred to Chittoor District. In 1960,

a few villages from Andhra Pradesh were added on account of Pataskar Award.

4. *South Arcot* ... No change.

5. *Salem* ... In November, 1927, a few villages of the Sankaridrug Sub-Division in Omalur Taluk and few villages from Dharmapuri Division became part of the newly formed Mettur District.

In 1929, the Mettur area (137 sq. miles) was added to Sankari Division. In 1950, 6 villages were transferred to Mysore State.

In 1960, 3 villages of Krishnagiri Taluk were transferred to Andhra Pradesh due to Pataskar Award.

6. *Coimbatore* ... In November 1927, 10 villages in Gobi Division of Bhavani Taluk along with some parts of the Salem District was constituted into the Mettur District. In 1929, the Mettur area (137 sq. miles) was transferred to Salem District.

In 1956, Kollegal Taluk was transferred to Mysore State.

7. *Nilgiris* ... No change.

8. *Madurai* ... In July 1932, the Vedasandur Sub-Taluk was abolished and certain villages were transferred to Tiruchirapalli District. In 1945, those villages were retransferred to Dindigul Taluk. Further 15 sq. miles were added to Ramanathapuram District from Madurai District.

9. *Tiruchirapalli* ... In July 1932, the Vedasandur Sub-Taluk was abolished and certain villages were transferred from Dindigul Taluk of Madurai District to Karur Taluk of Tiruchirapalli District. In 1945, some of these villages were retransferred to Dindigul Taluk. In 1948, the Pudukkottai State was merged with this District.

10. *Thanjavur* ... No change.

11. *Ramanathapuram.* In 1950, a few villages were added from Tirumangalam Taluk of Madurai District.

12. *Tirunelveli* ... In 1950, Anjengo, Thangasseri and a portion of Panagudi Village were transferred to Travancore-Cochin State. Shencottah Taluk was added from Travancore-Cochin State in 1956.

13. *Kanyakumari* ... This district was constituted in 1956, by merging Thovala, Agastheeswaram, Kalkulam and Vilavancode Taluks of former Travancore-Cochin State.

Vital Statistics for Kanyakumari District

Another major difficulty that we encountered was with regard to the tabulation of Vital Statistics for Kanyakumari District. The sources of Vital Statistics for this District prior to 1956 are the Annual Reports of the Health Department of the erstwhile Travancore State and also the annual publication "Statistics of Travancore." The presentation of data was more rational in the latter than in the former, and sometimes inconsistent with the former and judgement and patience were the only guides in resolving the conflicting figures. Moreover, the figures in respect of Travancore State prior to 1950 relate to Malayalam Era which roughly corresponds to the period from August to August. In 1950, the period of reporting was changed to the financial year ended March and the figures for Malayalam Era 1125 (1949–50) relate to only 7½ months, viz., August, 1949 to March, 1950. In 1956, there was a change over to calendar year on account of reorganisation of States whereas the figures upto 1955–56 relate to financial year ended in March. To ensure uniformity in the presentation of data, it was necessary to convert these figures into figures for calendar years. Since it is the universal experience that there is a certain amount of seasonality in the occurrence of births and deaths, I felt that it will be improper to assume that the births or deaths will be uniformly distributed in all the months or days. Hence the following procedure was adopted for 'adjusting' the data to calendar years.

Let p and q denote the proportion of births or deaths occurring in January to July and August to December

respectively and using the suffixes b and d for births and deaths respectively we have,

$$p_b + q_b = 1 \text{ or } q_b = 1 - p_b$$
$$p_d + q_d = 1 \text{ or } q_d = 1 - p_d$$

Denoting by B'n and D'n the births and deaths for year 'n' in calendar years and Bn, Dn those for the period in Malayalam Era covering the major part of the calendar year, then

$$B'_n = B_{n-1}\,p_b + B_n\,q_b$$
$$D'_n = D_{n-1}\,p_d + D_n\,q_d$$

The parameters p and q in the above relations were estimated from the monthwise figures of births and deaths for the State for 1956 to 1961. Similarly the proportions p and q for the years 1949 and 1950 and those for 1951 to 1955 had to be computed by summing up the births (or deaths) occurring in the segments constituting the calendar year. The values of p and q obtained thus are given below :—

	Births				Deaths			
	Rural		Urban		Rural		Urban	
	p	q	p	q	p	q	p	q
(1) Upto 1948	.563	.437	.558	.442	.570	.430	.574	.426
(2) 1949	.563	.666	.558	.670	.570	.627	.574	.624
(3) 1950	.334	.781	.330	.782	.376	.743	.373	.744
(4) 1951–55	.219	.781	.218	.782	.256	.744	.257	.743

Once these values were obtained, the figures for calendar years beginning from 1921 were computed by applying the formula discussed above. This difficulty will not arise in future since Kanyakumari district has now fallen in line with the other districts in the compilation of Vital Statistics and it will be left to them to make the series uptodate by adding up the Vital Statistics from 1961 onwards.

Registration through Panchayats

One of the recommendations of the State Panchayat Conference held at Madras on 8th and 9th October, 1961, is that the Panchayats in the State should carry out a monthly review of Births and Deaths in the village and thereby ensure the availability of correct and complete information about the growth of population in the village. The Madras Registration of Births and Deaths Act, 1899 requires that every birth and every death occurring in a village should be reported to the village Headman. He is to register them and send monthly returns showing the births and deaths that occur in the village. But he is unable to make sure that all births and all deaths have in fact been reported to him without exception. The result is that the monthly returns sent by him are incomplete. Data compiled from these returns are therefore defective. If however these data are correctly maintained from month to month and from year to year, it will be possible for every panchayat and every panchayat union to know accurately how population is growing in the village or block in its charge, which families remain small and which families are growing too large. Armed with accurate information, the Panchayat can discharge its duty of advising and reminding the people concerned. The Panchayat Union can watch how the different villages in the block are progressing.

As a first step, every panchayat was expected to ensure that the registration of births and deaths in the area in its charge is correct and complete. Under section 3 of the Madras Registration of Births and Deaths Act, 1899, the unit of area for purposes of registration of births and deaths is the revenue village. In the present organisational set up in rural areas, it is considered that the appropriate registration area will be the panchayat village. A panchayat village is the same as a revenue village. But in some cases, it may consist of two or more revenue villages. Where a panchayat village comprises more than one revenue village, the village Headman of the biggest revenue village will be appointed as Registrar of Births and Deaths.

Review of births and deaths occurring in the panchayat area shall be one of the prescribed subjects in the agenda for the monthly meeting of the panchayat. The Registrar of Births and Deaths shall attend the monthly meeting and submit the Registers of Births and Deaths to the panchayat. The President of the Panchayat shall read out the entries therein relating to the previous month and invite the members to notify births or deaths which have not been registered. The entries for each month will be few. It will be within the personal knowledge of the members of the panchayat whether any birth or death which does not find a place in the register, had actually taken place. The co-opted woman member of the panchayat can keep herself particularly informed on this point and make a special contribution to keeping the Birth and Death Registers accurate and complete. If any unregistered events are brought to the notice of the president by any member he shall record those

particulars in the registers for verification and registration later by the Registrar. If no omissions are reported, the president shall enter the remarks 'verified and found correct' in the registers and affix his signature.

In respect of Town Panchayats which have undertaken registration of births and deaths by extending the relevant provisions of the Madras District Municipalities Act, the Town Panchayats will appoint their own Registrars of Births and Deaths.

The Registers of Births and Deaths prescribed for rural areas have been revised with a view to simplifying them and ensuring proper collection of relevant particulars. Copies of the new forms and explanatory notes on the modifications made are given in the Appendices XII and XIII. These modifications have come into effect from 1st January, 1962.

In some Town Panchayats the registration work has been taken up by Health Assistants by extending the provisions of the Madras District Municipalities Act by a special resolution passed by the panchayat. A list of such panchayats is given in Table 1–4. It is not clear whether the extension of the Madras District Municipalities Act has contributed to any improvement in the registration in these areas. This is a matter which requires further investigation.

TABLE 1–4

List of Town Panchayats as on 1st March 1964 where the Madras District Municipalities Act has been extended

Name of District (1)		Name of Panchayat (2)		Date on which registration work taken up (3)
1. *Chingleput*	...	Kunrathur	...	1–12–59
		Poonamallee	...	1– 9–56
		Alandur	...	7– 2–37
		Villivakkam	...	1956
		Tirukkalikundram	...	1– 2–62
		Tambaram	...	1– 9–62
		Avadi	...	1–12–63
2. *North Arcot*	...	Nil	...	...
3. *South Arcot*	...	Nellikuppam	...	4– 8–53
		Panruti	...	8–12–48
		Tirukoilur	...	1– 6–50
		Kallakurichi	...	8– 8–61
4. *Salem*	...	Dharmapuri	...	1–12–61
		Tiruchengode	...	18– 8–60
		Denkanicottah	...	1– 9–58
		Velur	...	1– 9–58
		Idapadi	...	30– 1–60
5. *Coimbatore*	...	Satyamangalam	...	1–12–60
		Peelamedu	...	1– 4–60
		Uppilapalayam	...	1– 2–61
		Bhavani	...	1– 3–59
6. *Nilgiris*	...	Kotagiri	...	1– 7–53
		Melur	...	1– 4–57
		Gudalur	...	January '60
		Hulical	...	1– 6–64
7. *Madurai*	...	Allinagaram	...	1–10–54
		Sholavandan	...	1957
		Tirumangalam	...	25–11–57
		Melur	...	1– 9–58
		Usilampatti	...	24– 8–59
		Batlagundu	...	6–10–56
		Ammayanaickanur	...	7– 3–62
		Gudalur	...	1– 5–59
		Chinnamanur	...	1– 1–63
		Nilakottai	...	1– 5–64
8. *Tiruchirapalli*	...	Turaiyur	...	15–10–49
		Musiri	...	23–10–58
		Ariyalur	...	10–10–60
		Lalgudi	...	1– 2–59
		Golden Rock	...	1– 1–63
		Kattuputhur	...	1– 4–59
9. *Thanjavur*	...	Tranquebar	...	1– 1–61
		Sirkali (Siyali)	...	1– 9–58
		Kuttalam	...	1–10–59
		Ayyampet	...	8– 8–62
		Pattukottai	...	1– 4–63
10. *Ramanathapuram*		Paramakudi	...	1– 1–58
		Kandavarayanpatti	...	1– 1–59
		Tondi	...	1– 1–57
11. *Tirunelveli*	...	Tenkasi	...	1– 1–59
		Viravanallur	...	23– 9–53
		Kadayanallur	...	1–11–60
		Vickramasingapuram	...	1– 7–60
		Kovilpatti	...	August '58
		Eral	...	17– 6–52
		Tisaiyanvilai	...	1– 9–62
		Vasudevanallur	...	1– 3–63
12. *Kanyakumari*	..	Nil	...	...

Ad Hoc Census in 1962

In April, 1962, the Government of Madras conducted an ad hoc census. The objective of the ad hoc census was to estimate the mid-year population in 1962, by enquiring about the number of births and deaths during the period from the Pongal day (14th January, 1962) to 30th June, 1962. From the figures, the number of births and deaths for the period 1st March, 1962 to 30th June, 1962 was computed, and the population as on

1st March, 1962 was estimated by adding the natural increase (births minus deaths) in the period 1st March, 1961 to 1st March, 1962 to the population as on 1st March, 1961 obtained from the census. The agency employed for this ad hoc census was the Panchayatdars who were already charged with the work of registration of births and deaths.

On an average there were about 300 households and about 10 Panchayatdars in a panchayat village with an average population of 1,500. Out of the total number of births and deaths that occurred in a panchayat village, it was expected that the Registrar of Births and Deaths would register about 70% to 80% of the events. It was made the responsibility of the Panchayatdars to detect and bring on record the unregistered events which in all probability would not exceed two to three in a month in each panchayat village. The President of the Panchayat suitably allocated the number of households in the panchayat area to the Panchayatdars. The number of households allotted to each was about 30 or 40. They were requested to enquire from each head of the household or other person whether any birth or death actually occurred in his or her residence during the period from 14th January (Pongal day) to 30th June, 1962. Any birth or death that occurred outside the panchayat area, but subsequently brought into the area was omitted. It was expected that it should be possible for the Panchayatdars to complete this enquiry in about four or five days. In case a Panchayatdar was unable to visit all households allotted to him, he stated in Form C, the number of households visited by him and the number allotted to him.

In order to keep the work of the Panchayatdars at the minimum and to facilitate their work, each Registrar of Births and Deaths of a Panchayat village/town prepared a statement of births and another statement of deaths in Forms A and B respectively giving the particulars about the births and deaths that occurred and registered during the period from the 14th January to 30th June, 1962. The Registrar prepared on the 1st July, 1962 as many copies of these statements A and B as there were Panchayatdars and gave one copy to each of them. Each Panchayatdar checked up the entries of births and deaths registered to have occurred in the households allotted to him during his enquiry. Wherever any unregistered birth and death was detected he shall enter the particulars of the event in blank forms C and D supplied to him. The panchayat then reviewed the registered births and deaths and passed on to the Registrar of Births and Deaths, statements C and D containing particulars of unregistered births and deaths detected by them. The Commissioner of Panchayat Union then obtained the particulars in Form E from the Registrars of Births and Deaths in each village/town. These were in turn compiled in Form F and forwarded to the Director of Public Health, Madras along with duplicate copies of Form E sent by the Registrars.

The data were tabulated and analysed at the Office of the Director of Public Health, Madras and a report has been brought out. The instructions regarding the ad hoc census together with the forms prescribed are reproduced in Appendix XIV. The results of the ad hoc census are examined while discussing the accuracy of vital statistics in the next chapter.

Observations of earlier Census Superintendents

In the Census Report of 1881 for Madras, Mr. Lewis McIver has observed as follows :—

" Allusion has been made above (p. 78) to the absence of current vital statistics, that is, of birth and death registers with which to compare the census returns of age. There are, of course, birth and death registers, but they are of such inferior value as to be worthless for direct comparison with the figures of the census. Dr. Cornish, who has had 15 years' close familiarity with these registers says (page 120, Appendix B to the " Review of the Madras Famine, 1876-78 ") :—

" I have always been careful to inform Government, from year to year, that these vital statistics of the population are unreliable as an expression of absolute facts. As a statist, I should never dream of employing the results shown by registration to question the accuracy of a census, or to account for an increase or decrease of population..............As absolute indicators of increase or decrease of population, the birth and death returns are not only useless, but positively misleading." On the other hand, Dr. Cornish remarks (page 148) : " For comparison of results year by year, and for indicating geographical distribution of disease, the death registers have a value of their own, notwithstanding their imperfection. The errors are all errors of omission and in ordinary years a tolerably constant quantity."

This defect on the aggregate is as Dr. Cornish says chiefly one of omission. Mr. Stokes says : " It is probable that the rate of omission in the Presidency returns both for births and deaths is constant from year to year, since the number of returning officers, probably over 50,000 is so large." And on this assumption he proceeds to calculate those rates of omission with the following result. " Put more popularly, the above results may be stated to be, that for every 100 births

returned 218 actually occur ; for every 100 deaths under one year returned, 220 actually occur ; for every 100 deaths between one and six years of age returned, 154 actually occur ; for every 100 deaths between six and twelve returned, 144 actually occur ; and for every 100 deaths at all other ages returned, 181 actually occur."

"For certain purposes it may be safe to accept the error of these returns as exclusively one of omission and that on the whole the degree of omission is constant from year to year. But it is certainly not constant as between place and place nor is it equal in degree in the two sexes. It is certain that the town returns are fuller than the rural returns and it is also certain that the returns of some districts are much more complete than those of others. Besides this, it is probable in respect of the birth registers, for reasons repeatedly urged that the return of female birth is much less complete than that of males. The birth of a Hindu girl, save to herself, is so entirely unimportant ; it is so frequently, indeed, a matter of disappointment, that it will be long before this return can be safely accepted to be as complete even as that of males. This fact, although it may not affect some inferences from the registers as to the total births and deaths, materially affects the value of any comparison of the birth rate in the two sexes."

Mr. Stuart has observed as follows in the Census Report for 1891 :

"In concluding this section of the report, it will be of interest to compare the census results with those supplied by the statistics obtained from the registers of births and deaths. The registration of births and deaths in municipal towns is made by the municipal authorities and elsewhere the duty is entrusted to the village accountant. In municipal areas householders are bound by law to report births and deaths occurring in their houses, but no such obligation is imposed on the villager, and the accountant is required to obtain the information as best he can. In small villages this is not difficult, but, in those containing more than 1,000 inhabitants, there must be a number of deaths and births which never come to the notice of the registering officer, however energetic he may be in endeavouring to make his register complete and accurate ; and as in a large number of cases the village accountant is actuated by no such desire, it follows that the number of omissions is large. The record is most incomplete in Zamindari areas where the village accountants are under little control, but the inaccuracy is great everywhere as will appear from the following figures. The statistics for Anantapur and Bellary cannot be separated as until the middle of 1882 these two districts formed the old district of Bellary.

Births and Deaths

Districts	Births	Deaths	Excess of births over deaths	Increase of population by Census
Ganjam ...	233,452	202,255	31,197	147,304
Vizagapatam ...	313,229	237,860	75,369	321,708
Godavari ...	382,240	356,830	25,410	283,413
Krishna ...	506,596	330,387	176,209	307,102
Nellore ...	303,248	176,428	126,820	243,500
Cuddapah ...	337,726	227,159	110,567	151,034
Kurnool ...	269,519	173,773	95,746	139,260
Bellary & Anantapur.	505,951	298,097	207,854	282,511
Madras ...	164,498	158,257	6,241	46,670
Chingleput ...	393,053	239,903	153,150	155,547
North Arcot ...	556,354	352,906	203,448	357,614
Salem ...	553,076	311,667	241,409	369,676
Coimbatore ...	480,268	293,631	186,637	347,149
Nilgiris ...	16,005	14,992	1,013	8,763
South Arcot ...	512,756	381,415	131,341	347,128
Tanjore ...	614,746	519,205	95,541	97,095
Trichy ...	375,185	275,100	100,085	157,684
Madura ...	409,304	260,138	149,166	439,724
Tirunelveli ...	493,054	389,720	103,334	216,348
Malabar ...	569,329	443,011	126,318	287,530
South Canara ...	290,921	214,643	76,278	96,567
Total Madras Presidency ...	8,280,510	5,857,377	2,423,133	4,803,327

In the case of Ganjam, Vizagapatam and Madura, returns are not received from the whole district and the figures in those cases do not, therefore, admit of comparison with the increase shown by the census. Omitting these districts, the net excess of births over deaths is 2,167,401 and the increase according to the census is 3,894,591. The difference between these two figures is 1,727,190 which is 44.35 per cent of the census

increase. Both births and deaths have been largely understated, but the omission is greater in the case of births. The co-efficient of error differs in different districts and it would be a vain task to endeavour to calculate it. The relative discrepancies are least in Chingleput, Tanjore, South Canara and Cuddapah, but it must be remembered that in this statement no account is taken of the net loss by emigration, and in Tanjore this has been considerable. According to these vital statistics the mean annual birth-rate in the Madras Presidency, excluding the agency tracts and the districts of Ganjam, Vizagapatam and Madura has been about 28 per mille and the annual death-rate about 20 per mille. Judging by the mortality returns for the Madras City and making a liberal allowance for the slightly more healthy conditions found in rural tracts, the annual death-rate cannot have been less than 35 per mille and the birth-rate must, therefore, have been about 50 per mille. From these figures some idea can be gathered of the minimum rate of omission in the birth and death registers."

In 1901, Mr. W. Francis has made the following observations in the Census Report for Madras:

"In India, marriage is all but universal, and there are, therefore, an enormous number of births, but on the other hand, the mortality, especially the infant mortality, is equally abnormal and moreover the people are not so long-lived as in western countries. Mr. G. F. Hardy calculated the birth-rate in Madras during the decade 1881–91 to be 50 per mille. In England and Wales in 1899, it was only 29 per mille. The death-rate for the same decade (a prosperous and healthy one) he calculated to be 36 per mille. In England and Wales in 1899, it was only 18 per mille. In England about 17 per cent of the boys and 13 per cent of the girls who are born die before they are one year old. Mr. Hardy estimated that in Madras the numbers were as high as 26 and 23 per cent respectively. The expectation of life, of a boy of 10 years old is 39 years in Madras against 48 (Life Table No. IV) in England, and of a girl 38 years against 50 years in England. Thus early and almost universal marriage has not as marked an effect on the rate of increase of the population as might be expected.

What, however, is the exact ratio of births to deaths it is impossible to say, for the registration of both of them in this Presidency is so incomplete that the statistics returned are worthless in all matters in which exactness is required. All the figures for Madras quoted above are deductions from the census results, which are the only reasonably accurate guide available in the matter. It could be shown that the probable population of a district at any given date calculated from the vital statistics usually differs greatly from the actual results obtained at the census, and that the difference is as often one of over-statement as of under-statement.

Probably, the only place where registration is effective is Madras City, where the provisions of the law compelling registration (sections 394–404 of the City of Madras Municipal Act of 1884) seem, from the agreement which exists between the birth and death-rates recorded there with those calculated from other sources, to be strictly observed. In the district municipalities, the law on the subjects (sections 243–249 of Madras Act IV of 1884) is much the same as in Madras City, but that it is less rigidly enforced is clear from the fact that the recorded ratio of both births and deaths per mille of the population in these municipalities is much less than in Madras City. The only explanation of these differences is that omissions to register are frequent. There were, it is true, 8,734 prosecutions under these two Acts in the eight years between 1893 and 1900, but in the quarters of the lower classes of the population the arrival of a baby is a matter of such small account and its death and burial occasion such small remark that it is most difficult to detect cases in which registration has been neglected.

Outside municipal areas, the registration of births and deaths was nowhere compulsory until the passing of Madras Act III of 1899. This came into force so late in the decade with which we are concerned and has been extended to so few places (it does not operate in any area until extended thereto by notification) that its effect on recent vital statistics is negligible and for all practical purposes registration may be assumed to have been compulsory nowhere outside municipalities between 1881 and 1891. No registration of any kind was even attempted in the agencies of Ganjam or Vizagapatam, in several Zamindari areas in the former district and in Madura, or in the Laccadive Islands.

In rural areas other than these, registration is done by the village accountants under the supervisions and control of the Revenue Department and the results are compiled and criticised by District Medical and Sanitary Officers and the Sanitary Commissioner. In theory this registration is constantly checked by subordinate officers of the Revenue and Sanitary Departments, but the Board of Revenue stated in March 1900 that it was "undoubtedly a fact" that the system had "not been a success," and the Honourable Member who introduced into the Legislative Council the Bill which subsequently became Act III of 1899 described it as "so

defective that the results are grossly erroneous and misleading." A glance at the figures returned is sufficient to confirm the accuracy of these opinions. Both the birth and death-rates are impossibly low ; still-births are only 1 per cent of all births against 4 per cent, the estimated proportion in England ; and the ratio of male still-births to female is only 112, which is lower than that in any western country of which I have statistics.

The reasons are not far to seek. No penalty can be enforced for failure to register, the village accountant has a great deal of other work to do, and for news about births and deaths in the paracheris of his village wherein he cannot himself enter without ceremonial pollution, he is dependent upon the village menial servants, who cannot read or write and do not see how omissions to mention such occurrences can matter. The proportion of omissions is probably more or less constant and the effect of bad seasons can usually be traced in the figures by the reduced birth-rates and the enhanced death-rates, but in an enquiry into the movement of the population, rural vital statistics are too inaccurate to be of assistance."

Mr. Molony in his Census Report of 1911 for Madras has observed as follows :

" When we remember that registration is not enforced over the whole area of the Presidency, it seems but natural that the census increase should exceed that shown by registration. The difference is small (378,583) and the registration figures of Madras, when examined with reference to those of India, contain a certain inherent probability of accuracy. The total excess of census over registration in India is 2,361,658 and this excess is accounted for almost entirely under the head of males (1,866,735). This condition is reversed in the case of Madras where the excess is mainly on the female side (281,963) ; a state of things rendered entirely probable by the reluctance of the Madras parent to proclaim abroad the advent of a daughter."

In the All-India Report for 1931, Mr. Hutton has made the following remarks :

" Vital statistics of Madras are worthy of reference since this Province is the only one whose registration of births and deaths approaches anything like a satisfactory standard. Even so in 1930 some 62,000 unregistered births and 20,000 unregistered deaths were detected by inspecting offices in the Presidency. As for the accuracy of her vital statistics, Madras is ahead of other provinces in the matter of birth control. A tendency is observed by the Census Superintendent for men at any rate to marry later and contraceptive methods are advocated by influential persons and widely advertised in the press. "

Mr. Yeatts in 1931 has given a comprehensive account of vital statistics in Madras State:

" The institution of a separate Public Health Body of officers throughout the Presidency has brought about a much closer control over vital statistics and the great improvement in the registration of these details is one of the most notable features of public health during the decade. Public health activities depend so much on statistics that a high standard of registration is essential if reliable deductions are to be made. Registration of vital statistics in the Presidency began in 1865 when under the orders of the Board of Revenue village headmen were required to maintain birth and death registers. Registration was not obligatory until an Act was passed in 1899 providing for the registration of births and deaths in rural tracts. This Act is enforced only in those rural areas to which it has been extended by notification. In such areas registration is compulsory with penalty in case of failure. The general sequency is : the village headman sends a monthly return to the taluk office ; this last sends these returns to the Collector's office and there consolidated results are worked out for each district and are finally sent to the Office of the Director of Public Health. From 1925 district health officers have been scrutinising these consolidated returns prior to their despatch to Madras. Municipal Councils are in charge of registration in their areas and under an Act of 1920 registration is compulsory in all municipalities. At present registration is compulsory throughout the Presidency except in most of the Agency tracts, the Laccadive Islands and one or two other small areas.

The above enactment provided from a general point of view ample powers of securing efficient registration. In practice, however, Madras vital statistics are anything but above cavil. An exhaustive investigation proved the birth-rate to be 42.5 per 1,000. Yet according to the Public Health Statistics in 1921 the average birth-rate varied from 27 to 31 while individual oscillations ranged from 47 in Periyakulam to 68 in Chirala. Such figures could not possibly represent facts and an example of the effects which gross neglect of registration can produce is given by a municipality in Chingleput district where out of 41 births discovered 26 had not been registered and out of 62 births attended by hospital midwives 36 had not been registered. In later years Public Health Officers in the districts have devoted

the intercensal population estimates for the towns constituting the urban area during that year in the manner described earlier. Further, let Bi, Di (i = 1 to 10) be the births and deaths in the year i in the areas treated as urban during that year, then $\frac{Bi}{Pi}$ and $\frac{Di}{Pi}$ (omitting the constant factor 1,000) will give the birth and death-rates for that year. The mean decennial birth and death-rates are then given by

$$\text{Mean decennial birth-rate} = \sqrt[10]{\frac{B_1}{P_1} \cdot \frac{B_2}{P_2} \cdots \frac{B_{10}}{P_{10}}}$$

$$\text{Mean decennial detha-rate} = \sqrt[10]{\frac{D_1}{P_1} \cdots \frac{D_{10}}{P_{10}}}$$

respectively. The above procedure has been adopted by us for computing the decennial birth and death-rates discussed in later chapters.

CHAPTER II

ACCURACY OF VITAL STATISTICS IN MADRAS STATE

An evaluation of the accuracy of the Vital Statistics of the State is the first step in any demographic study. Registration of births and deaths is compulsory in the rural areas of the State except in the few villages mentioned in Chapter I which have been excluded from the operation of Act III of 1899. In the rural areas of Kanyakumari District and Shencottah taluk of Tirunelveli District, registration of vital events is compulsory under the Travancore-Cochin Registration of Births and Deaths Act, 1954. In the three Township areas, registration of births and deaths is compulsory and the Health Inspectors of the areas have been appointed as birth and death Registrars. Registration is compulsory in all municipal areas including the municipal towns of Kanyakumari District and Shencottah municipality. In the latter areas, rules issued under the Travancore-Cochin Municipal Act are in force.

In practice, our registration system has two serious limitations, one administrative and another statistical. Both omission and misreporting can take place in a system in which a large number of persons are engaged, whatever be the legal basis of such a system. The duty of recording vital events has been for a long time entrusted to the village officers and sanitary staff of municipalities. The system was maintained at a high level of efficiency in the past because of the effective supervision of the work of such staff by the superiors. Owing to the preoccupation of the present staff with the development work and inherent weakening of supervision as a result of democratization of administration, the standard of reporting of births and deaths in the rural as well as urban tracts of the State has fallen. Nor is the citizen inclined to consider the reporting of births and deaths a duty cast on him. As such, he is not prepared to incur the discomfort involved in reporting births and deaths. Lack of printed forms, indifference on the part of midwives and medical officers attending on births and deaths are other factors leading to incomplete coverage of births and deaths. As such, it is not a matter for surprise that the coverage which stood between 80 and 90% in the past has fallen to 70% in the decade 1951-61.

In 1932, the responsibility of compiling returns was entrusted to the Statistical Branch of the Director of Public Health. It has compiled the statistics collected and sent by the Tahsildars of the State and presented them to the reader in an intelligent form ; but no effort has been made by the Statistician of Public Health Department to see that the compilation is made on a scientific basis. All that has been done to ensure greater accuracy of return is to issue circular letters from time to time to the Collectors concerned. No attempt has been made by the Statistician to classify the areas of registration into good, indifferent and bad nor has any attempt been made to fix the probable degree of under registration in different parts of the State by any sample study. The occurrence of births and deaths has a certain periodicity and it is therefore possible to observe and record the rates of under-registration which will change from time to time depending on the quality of the human agency involved. Again, Madras State has a large number of agencies reporting births and deaths. They vary in size and population. The method adopted by the Statistician to forecast the shortage of returns is extremely primitive and unscientific. It is not correlated to the size and the area covered by the particular return. The whole State has been covered from 1951 Census onwards by a system of Location Code which ensures that no geographical area is omitted from census count. This Location Code has not been utilised in checking the receipt of returns from different agencies. I had a discussion with the Director of Public Health and his Statistician on this subject and I hope an effort will be made in future to ensure that the statistical accuracy of birth and death returns is enhanced by ensuring that all returns are received and secondly wherever there is marked under registration, specific attempts will be made to bring that area upto the mark. The analysis we have made in this Chapter will perhaps be helpful in undertaking a more scientific compilation of birth and death statistics in Madras State.

Whatever be the difficulties of registration system, we still have a well maintained system of registration and it will be possible to estimate the extent of inaccuracy inherent in the present system. For this purpose several figures regarding the probable birth and death-rates for Madras State at different periods of time have been examined. In this connection, it may be useful to have an idea of the investigations made earlier on this subject.

Earlier investigation on the accuracy of vital statistics

So far seven important investigations on the vital registration in the State have been made which are examined below :

1. *Russel's investigation*

The defectiveness of the records of vital registration was subjected to an exhaustive examination by A. J. H. Russel the then Director of Public Health, Madras, in his annual administration report for 1921 and he submitted a memorandum summarising in concrete form the causes of bad registration and the lines on which accuracy may be improved. Since his investigations not only throw valuable light on the deficiency of vital registration of his time but may perhaps be true even today, it is worth recalling them.

Russel has observed from his enquiries that the average birth-rate of the Presidency which included the Andhra areas should be of the order of 41.5 in 1921, whereas the registered rates for the districts as well as the municipalities fell considerably short of this. Not a single district attained the average rate of 42.5 and only three out of the 81 municipalities in the Presidency reached that figure. In many towns, the returns worked out at less than 10 per mille, and in some cases even less than 5.

In order to determine the exact cause of these phenomenal rates, an interesting and perhaps intensive enquiry was instituted by him in certain places which returned rates far lower than the villages around them. The Assistant Director of Public Health who was asked to investigate was able to trace considerable numbers of local births which had escaped registration, and in many villages and towns where medical institutions exist, even many births attended by the hospital midwives were omitted from the registers. The results for a few of the places of the present Madras State are reproduced below.

TABLE 2-1

Omission in Birth Registration revealed by 1921 Enquiry

District	Town	No. of births discovered	No. of these not registered	Births attended by hospital midwives	No. of these not registered
Chingleput	... Saidapet ...	41	26	62	39
„	... St. Thomas Mount ...	55	43	82	81
Coimbatore	... Mettupalayam ...	35	23	156	55
Nilgiris	... Kotagiri ...	21	14	16	16
Madurai	... Tirumangalam ...	40	30	...	...
Tiruchirapalli	... Lalgudi ...	39	24	62	43
Ramanathapuram	... Devakottai ...	57	53	52	51
„	... Rajapalayam ...	99	80	...	...

TABLE 2–2

The discrepancies between the Statistics of Union Towns included in the Returns and the Statistics actually registered (1921 Enquiry)

District	Name of Union or town	Population	Name and population of village to which the return has been actually found to relate	Vital occurrences in the union or town: Births — According to return	Births — As per register	Deaths — According to return	Deaths — As per register
1	2	3	4	5	6	7	8
1. Chingleput ...	Sembiyam villages (6)	24,235	Sembiyam (5,347) ...	182	549	131	584
	Pallavaram villages (3)	8,753	Pallavaram Cantonment (3,431)	87	240	63	155
	Poonamallee villages (5)	17,549	Poonamallee town and Cantonment (5,403)	231	*709	160	*455
	Tiruvottiyur villages (2)	8,100	Tiruvottiyur (5,635) ...	139	208	150	218
2. Tiruchirapalli ...	Lalgudi villages (7) ...	16,453	Abishekapuram (4,977) ...	136	475	121	366
	Turaiyur villages (2) ...	13,546	Turaiyur (8,737) ...	234	311	178	246
3. Tirunelveli ...	Tiruchendur villages (2)	8,883	Kilatiruchendur (7,754) ...	220	193	...	...

*Excluding the statistics of Nazarethpetta village (population 1,545).

Russel has made the following observation from these figures : "It is usual for the local authorities to explain low birth-rates as due to natural causes. In view of the foregoing facts, of the constant discovery by vaccination staff of unrecorded births (*e.g.*, in Rajapalayam over 600 unregistered cases were discovered by the vaccination staff), and of the census returns which show increases in population utterly incompatible with the birth and death-rates recorded in the intercensal period, the explanations offered by the local officers must be at once rejected as a mere cloak for dereliction of duty.

Deaths do not escape notice so easily as births for obvious reasons. Also, owing to the peculiar susceptibility of India to epidemic diseases, death-rates vary from year to year, and an area which is devastated by epidemic disease shows a higher rate than an area which is lucky enough to escape such a visitation. This, however, does not explain why some towns show annual death-rates of less than 10 or even less than 5 per mille *e.g.*, Pernampattu (4.7), Cumbum (4.1), Tuni (3.5) and Tiruvattur (3.2) while Guntakal in Anantapur District and Pallikonda in North Arcot District returned a still more ridiculous death-rate of 2.6 per mille in a population of 12,519 and 7,755 respectively. In a tiny hamlet, such a phenomenon might occur. That these figures represent facts in a town of more than 5,000 inhabitants none can believe."

TABLE 2–3

Vital Statistics of certain Towns and Villages in Madras State (1921 Enquiry)

District	Town or village	Number of births discovered	Number registered among those shown in Column 3	Percentage of omissions	Number of births conducted by hospital midwives	Number registered among those shown in Column 6	Percentage of omissions	Birth-rate according to statistical return	Estimated birth-rate by actual investigation	Remarks
1	2	3	4	5	6	7	8	9	10	11
1. Chingleput ...	**Saidapet** ...	41	15	63.4	62	23	62.9	10.3	*42.0	* Out of two deaths discovered, none has been registered.
	Tiruvottiyur ...	41	26	36.5	54	26	51.8	17.2	36.1	
	St. Thomas Mount ...	55	12	60	82	1	98.7	13.0	*46.9	* Out of ten deaths discovered, only one was registered.
	Poonamallee (Cantonment) ...	26	18	30.7	...	...	...	13.2	46.1	
	Sembiyam ...	28	12	57.1	...	...	...	7.5	28.5	
2. Coimbatore ...	**Mettupalayam** ...	35	13	62.8	156	101	35.2	15.6	43.3	None of the two deaths which were discovered has been registered.
3. Madurai ...	**Tirumangalam** ...	40	10	75	...	...	60 (approximate)	17.8	44.4	
	Melur ...	42	21	50	157	107	31.8	13.8*	44.3	* Calculated on 1911 Census population on account of partial evacuation of the town in 1921.

4. Nilgiris ...	Kaiti ...	19	9	52.6	2	Nil	100	18.4	43.4	
	Kotagiri ...	21	7	66.6	16	Nil	100	20.8	42.0	Out of six deaths discovered, four have not been registered.
	Coonoor ...	27	18	33.3	19	12	36.8	16.7	41.0	
	Ootacamund ...	71	44	38.02	...	...	...	36.3	39.4	
5. Ramanathapuram	Devakottai ...	57	4	92.9	52	1	98.07	2.6	42.7	
	Rajapalayam ...	99	19	80.8	...	...	...	11.0	42.2	
	Kamudi ...	67	(Register not available)		14	3	78.5	13.8	46.5	
	Manamadura ...	9	2	77.7	59	...	50 (approximate)	...	...	
6. Tirunelveli ...	Tiruchendur ...	48	17	64.5	49	6	87.7	15.6	36.0	Out of the three deaths discovered, one has not been registered.
	Kulasekharapatnam ...	...	...	...	78	33	57.6	...	...	
7. Trichirappalli ...	Lalgudi ...	39	15	61.5	62	19	69.3	8.3	42.0	
	Turaiyur ...	40	31	22.5	...	...	...	17.3	45.3	

More results of his investigations are set out in Table 2–2. This Table shows that in most areas a considerable number of deaths and a far larger number of births are never registered. If the births are understated and deaths are not, infant mortality will be unduly high and so also the percentage of births attended by midwives. He has pointed out that although the registered infant mortality rate for Bezwada town (now in Andhra State) in 1921 was as high as 358, not a single child born in the large railway colony within the municipal boundaries had been registered. " It so happens that Madras City usually appears near the bottom of the list with a higher rate of infant mortality than almost any other area of the Presidency. In 1921, the infant death-rate in Madras City was 283 per mille against 96 for Bodinayakkanur. But the total death-rate for Bodinayakkanur was only 11.5, a figure which no one would accept as correct for Bodinayakkanur is certainly anything but a sanatorium. It is probable that the registration of vital statistics is as efficient in Madras City as anywhere in the Presidency, if not more so."

Two major drawbacks observed by him are incompleteness of registration and discrepancies in posting the data. These are highlighted by the figures in Table 2–4.

TABLE 2–4

Discrepancies between the Statistics contained in the Returns and the Registers (1921 Enquiry)

District	Town	Births in 1921		Deaths in 1921	
		As per return	As per register	As per return	As per register
Chingleput	Sembiam	182	166	131	129
,,	Poonamallee CT	103	115	87	93
,,	Poonamallee Town	128	129	73	83
,,	Saidapet	281	471	248	465
Coimbatore	Mettupalayam	165	169	168	372
Madurai	Tirumangalam	187	182	195	185
Tiruchirapalli	Turaiyur	234	224	178	164
Ramanathapuram	Rajapalayam	319	364	140	158

One of the reasons for the low birth and death-rates for the Districts (rural areas) is the non-receipt of returns for several villages whereas for working out the rates, the population of these villages is included. In the case of union towns (now known as census towns), most of which include more than one revenue village, and sometimes parts of several revenue villages, it very frequently happens as may be seen from Table 2–2 that the statistics of some of the villages included or partly included in the union limits, are omitted from the union returns. The population of the main village is frequently only a fraction of the total population of the union, and it is inevitable that in such cases very low birth and death-rates are derived from the returns. Sembiam union for instance has submitted a return showing 182 births and 132 deaths whereas the actual numbers registered are 549 births and 584 deaths.

An important result of this investigation was the realisation on the part of Government about the deficiencies in Vital Registration. Government issued a circular to all Collectors pointing out the various defects in the registration system and they were asked to take steps to give effect to the instructions issued. This has been followed by numerous efforts for improvement of registration. In 1951–52, a sample census was carried out with a view to determine the extent of under registration in the registered rates.

2. *Sample Census of births and deaths*, 1951–52

The experimental census of births and deaths was conducted during the period September—October 1952 in selected sample households in about one-fifth area in each district of Madras State. The reference period for the sample census was 1st September 1951 to 31st

TABLE 2-5

Number of Births in Sample Households and their registration by Districts, 1951-52

Districts	T R U	No. of mothers	Total No. of births			Whether birth was registered					
						Yes		No		Not known	
			P	M	F	M	F	M	F	M	F
1. Madras ...	T	233	236	118	118	93	99	3	5	22	14
	R	...	...	...	...	...	...	...	...	...	...
	U	233	236	118	118	93	99	3	5	22	14
2. Chingleput ..	T	107	109	50	59	35	44	9	3	6	12
	R	75	77	36	41	24	31	8	2	4	8
	U	32	32	14	18	11	13	1	1	2	4
3. North Arcot ...	T	119	121	65	56	52	47	9	4	4	5
	R	82	83	43	40	32	34	7	3	4	3
	U	37	38	22	16	20	13	2	1	...	2
4. South Arcot ...	T	138	141	73	68	58	51	9	8	6	9
	R	110	113	58	55	44	39	8	8	6	8
	U	28	28	15	13	14	12	1	...	...	1
5. Salem ...	T	157	158	78	80	64	66	4	8	10	6
	R	111	112	60	52	51	45	3	4	6	3
	U	46	46	18	28	13	21	1	4	4	3
6. Coimbatore ...	T	131	131	66	65	53	50	...	4	13	11
	R	80	80	40	40	31	34	...	2	9	4
	U	51	51	26	25	22	16	...	2	4	7
7. Nilgiris ...	T	85	85	39	46	32	31	5	10	2	5
	R	64	64	30	34	25	22	3	8	2	4
	U	21	21	9	12	7	9	2	2	...	1
8. Madurai ...	T	124	124	67	57	50	30	6	8	11	19
	R	95	95	50	45	38	23	4	7	8	15
	U	29	29	17	12	12	7	2	1	3	4
9. Tiruchirapalli ...	T	149	150	77	73	53	53	3	3	21	17
	R	115	116	64	52	46	38	3	2	15	12
	U	34	34	13	21	7	15	...	1	6	5
10. Thanjavur ...	T	123	123	58	65	41	50	2	1	15	14
	R	76	76	43	33	28	26	2	1	13	6
	U	47	47	15	32	13	24	...	...	2	8
11. Ramanathapuram ...	T	116	116	55	61	37	31	8	8	10	22
	R	80	80	36	44	26	22	2	4	8	18
	U	36	36	19	17	11	9	6	4	2	4
12. Tirunelveli ...	T	136	139	75	64	64	40	4	11	7	13
	R	81	82	37	45	30	28	3	9	4	8
	U	55	57	38	19	34	12	1	2	3	5
Total ...	T	1,618	1,633	821	812	632	592	62	73	127	147
	R	969	978	497	481	375	342	43	50	79	89
	U	649	655	324	331	257	250	19	23	48	58

Based on the sample census of births and deaths 1951-52.

TABLE 2–6

Number of Deaths in Sample Households and their Registration by Districts, 1951–52

Districts	T R U	No. of deaths			Whether death was registered					
					Yes		No		Not known	
		P	M	F	M	F	M	F	M	F
1. Madras ...	T	206	113	93	95	79	6	4	12	10
	R	...	...	...	...	...	...	...	...	...
	U	206	113	93	95	79	6	4	12	10
2. Chingleput ...	T	72	46	26	38	17	4	5	4	4
	R	53	34	19	28	15	4	4	2	...
	U	19	12	7	10	2	...	1	2	4
3. North Arcot ...	T	94	47	47	34	39	8	6	5	2
	R	73	37	36	25	28	7	6	5	2
	U	21	10	11	9	11	1	...	...	...
4. South Arcot ...	T	118	65	53	47	40	13	11	5	2
	R	99	56	43	41	34	11	7	4	2
	U	19	9	10	6	6	2	4	1	...
5. Salem ...	T	66	40	26	29	19	9	7	2	...
	R	52	32	20	23	15	7	5	2	...
	U	14	8	6	6	4	2	2	...	...
6. Coimbatore ...	T	74	38	36	30	27	3	7	5	2
	R	52	27	25	21	19	3	5	3	1
	U	22	11	11	9	8	...	2	2	1
7. Nilgiris ...	T	29	9	20	4	15	4	3	1	2
	R	24	7	17	3	13	3	2	1	2
	U	5	2	3	1	2	1	1	...	...
8. Madurai ...	T	111	59	52	49	41	4	6	6	5
	R	74	44	30	35	22	4	4	5	4
	U	37	15	22	14	19	...	2	1	1
9. Tiruchirapalli ...	T	110	66	44	52	33	6	1	8	10
	R	73	47	26	35	20	6	1	6	5
	U	37	19	18	17	13	...	...	2	5
10. Thanjavur ...	T	95	42	53	31	37	5	5	6	11
	R	52	22	30	18	20	...	3	4	7
	U	43	20	23	13	17	5	2	2	4
11. Ramanathapuram ...	T	78	36	42	23	27	3	8	10	7
	R	59	26	33	18	21	2	6	6	6
	U	19	10	9	5	6	1	2	4	1
12 Tirunelveli ...	T	82	37	45	26	29	4	8	7	8
	R	43	19	24	13	13	4	6	2	5
	U	39	18	21	13	16	...	2	5	3
Total ...	T	1,135	598	537	458	403	69	71	71	63
	R	654	351	303	260	220	51	49	40	34
	U	481	247	234	198	183	18	22	31	29

Based on the sample census of births and deaths. 1951–52.

August 1952, and all births and deaths which occurred during this period was intended to be covered. The work was entrusted to officers of the grade of Revenue Inspectors and above, who were designated as supervisors. One in one hundred households was selected for the purpose of sampling. The sample households were selected from the National Register of Citizens treating the entire supervisors area as a unit. Supervisors were asked to note cases of births and deaths in the selected sample households during the specified period in separate birth slips and death slips. They were also asked to note whether these cases of births and deaths noted by them were already registered or not or were cases about the registration of which they had no information. The birth and death slips were sorted for each district and the results tabulated.

It is seen, that the rates arrived at as a result of the census of sample households are very much lower than the rates arrived at from the recorded births and deaths. It is an accepted fact that the recorded births and deaths suffer from under registration, and so the sample census has a greater measure of under registration. In spite of the unsatisfactory results, we find that the percentage of registered, unregistered and unknown death is 75.9, 12.3 and 11.8 respectively. The percentage of registered, unregistered and unknown births is 75.0, 8.3 and 16.7 respectively.

3. *Life Table Death Rates*

In the absence of accurate Vital Statistics, census actuaries have placed reliance on age returns of successive censuses for obtaining a picture of mortality in India and in different regions. One major limitation pointed out by Kingsley Davis is the attempt of the actuaries to define a normal period or a period free from natural calamities in each intercensal period. They reasoned that if the decade had suffered a widespread famine or epidemic that decimated the population, the life table for that decade should be so adjusted as to ignore or at least modify the effect of the catastrophe, assuming that famines and epidemics are not normal. But the object of a life table is to show the actual mortality and not the 'normal' mortality and the life tables of the past which ignore such mortality do not therefore give a true picture of the mortality of those decades.

It does not however follow that absolutely no historical information can be gained from these tables. The knowledge that the earlier life tables understate the chance of death merely makes their results all the more striking, since the mortality revealed by them is very high. They give for the South Zone an expectancy of life at birth of between 23 and 25 years, and the actual life expectancy should have been considerably less. The official life tables are available for the South Zone for all decades except for the decades 1911–21 and 1931–41 for which official life tables are not constructed. However Kingsley Davis has built up the life tables for India for these decades and it will be possible to obtain a picture of mortality in the South Zone on a pro-rata basis using the adjoining life tables for India and South Zone. The figures of life expectancy at birth, together with the average annual death-rate they imply are given in Table 2–7.

TABLE 2–7

Life Expectancy at Birth and Implied Annual Death-Rates

Decade ending		Life expectancy at birth (e_0^o)		Life table death-rates ($1/e_0^o \times 1000$)	
		M	F	M	F
1881	...	22.35	24.18	44.74	41.36
1891	...	26.92	27.99	37.15	35.73
1901	...	26.21	27.13	38.15	36.86
1911	...	25.92	27.65	38.58	36.17
1921	...	19.75	24.23	50.63	41.27
1931	...	28.71	30.04	34.83	33.29
1941	...	35.03	36.19	28.55	27.63
1951	...	36.22	37.23	27.61	26.86
1961	...	41.09	39.24	24.33	25.48

4. *Census Actuarial Estimates*

From time to time, the census actuaries have prepared estimates of birth-rate for India and several States. These have generally been made on the basis of census returns and life table values—independently of the registration statistics and they have some claim to validity. For instance G. F. Hardy, the actuary for the census of 1881, 1891 and 1901 has made estimates of the average birth-rate for the three decades in question. In 1911, T. G. Ackland the census actuary, has prepared the estimates of the birth-rate for 1901–11. In 1951 and 1961 S. P. Jain, the census actuary for the

1951 and 1961 censuses has prepared similar estimates. Their findings are given in Table 2–8.

TABLE 2–8

Estimated Birth-Rates for Madras and other Provinces

State	Hardy's estimates[1]			Ackland's estimate[2]		Jain's estimates[3]	
	1871–81	1881–91	1891–1901	1901–11 I	II	1941–51	1951–61
Bengal ...	47.9	52.9	43.9	46.7	56.0	35.4	42.9
Bombay ...	50.5	50.3	43.9	41.0	50.8	41.0	45.7* 41.2*
Madras ...	50.4	51.3	44.8	41.9	47.2	35.7	34.9
Punjab ...	45.2	46.8	47.1	44.3	52.9	41.2	44.7
United Provinces ...		45.1	44.7	46.5	47.7	38.6	41.5

Source : 1. Actuarial reports of 1881, 1891, 1901.
2. I. Actuarial report for 1911 and
II. Journal of the Institute of Actuaries, July 1913, p. 325.
3. Census of India, Paper No. 6, 1954 & Life Tables, 1951–60.

*Figures relate to Gujarat and Maharashtra.

The estimates given here with the exception of the last decade, relate to the composite Madras State and are therefore only of limited validity to the present State. Although these estimates are very rough and are not made by a uniform method, they give an indication of the magnitude of Madras birth-rate during the last century and its relative magnitude in comparison with those of other States.

The census actuaries have also attempted estimates of the death-rates in different decades. The technique of estimation of deaths depended upon a knowledge of births. If the births occurring between two censuses are known, their number minus the increase in the population (assuming no migration) should equal the number of deaths during the period. Another method commonly employed is the Differencing Method where the difference between the population at one census and those aged 10 and above at a subsequent census is used for estimating the death-rate. Most of the census actuaries in the past have employed this method and derived the birth-rate as a residual from the growth rate. Jain has adopted this method as well as the Reverse Survival Method to estimate the birth and death-rates. The rates obtained by the census actuaries are given in Table 2–9.

TABLE 2–9

Estimated Death-Rates for Madras and other Provinces

State	Hardy's estimates[1]			Ackland's estimate[2]		Jain's estimates[3]	
	1871–81	1881–91	1891–1901	1901–11 I	II	1941–51	1951–61
Bengal ...	39.9	45.9	38.9	40.0	48.7	28.6	20.5
Bombay ...	42.5	36.4	45.9	35.8	45.6	24.9	23.5* 19.8*
Madras ...	44.5	38.0	38.1	33.4	38.7	22.8	22.5
Punjab ...	39.2	37.0	40.0	43.3	47.2	26.3	18.9
United Provinces ...		38.6	43.4	46.0	47.1	27.2	24.9

Source : 1. Actuarial reports of 1881, 1891 and 1901.
2. I. Actuarial report for 1911.
II. Journal of the Institute of Actuaries, July 1913, p. 325.
3. Census of India, Paper No. 6, 1954 and Life Tables, 1951–60.

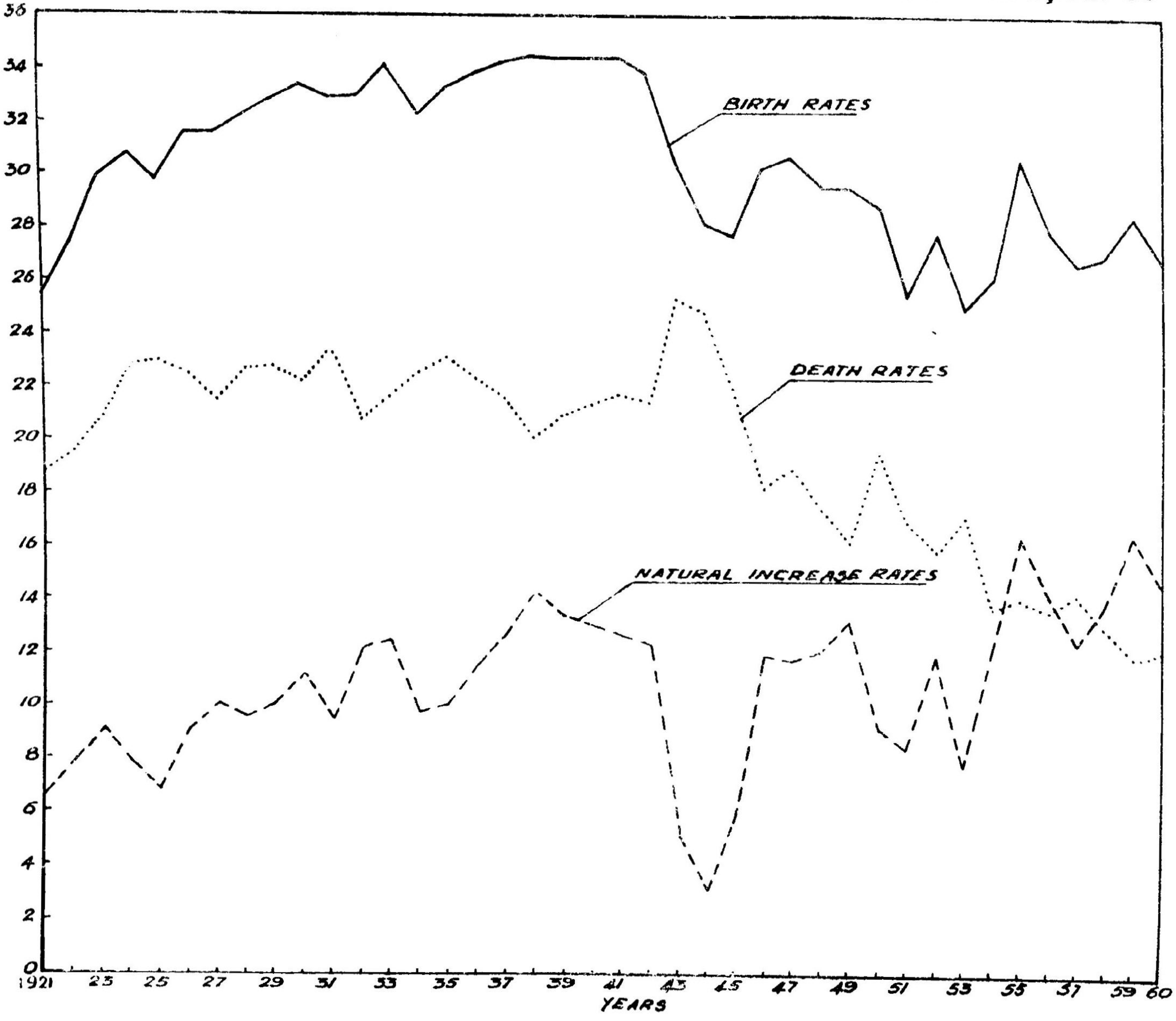
* Figures relate to Gujarat and Maharashtra.

It should be kept in mind that these figures with the exception of the last decade, relate to the composite Madras State which included some of the famine tracts. The death-rate for the present Madras State should have been less than that of the composite Madras State. However this is likely to be compensated by the fact that the earlier figures fall short of reality by a greater amount than the later ones and therefore the above figures may be taken to indicate the trend over the several decades.

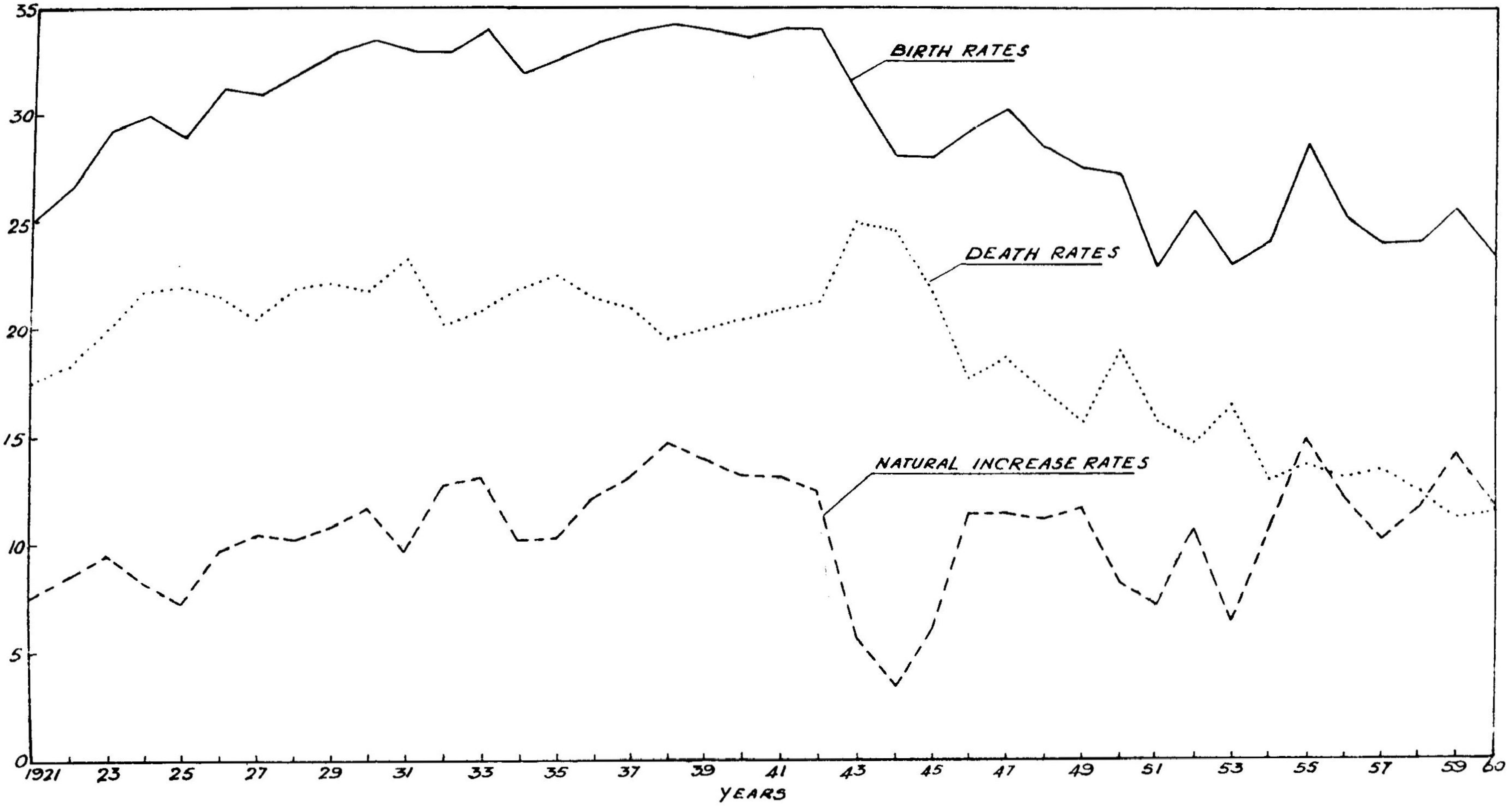
5. *Kingsley Davis' Estimates of Birth-Rates*, 1926–30

Kingsley Davis has attempted two estimates of birth-rates for 1926–30. One method is the well known Reverse Survival Method where starting with the 0–9 age group, in the 1931 Census he estimated the births during the decade using the life tables. In the Second Method, he compared the census returns for children with the registered births. Each single year age group in the census was followed back on the basis of the deaths registered by age to the births that must have occurred in order to make the census figures possible. The estimated births are then matched with the actually recorded births to form a notion of the extent of under-registration. After a first estimate of births has been made, it was assumed that deaths are equally under-registered and the deaths are increased accordingly. This method of successive approximation was carried

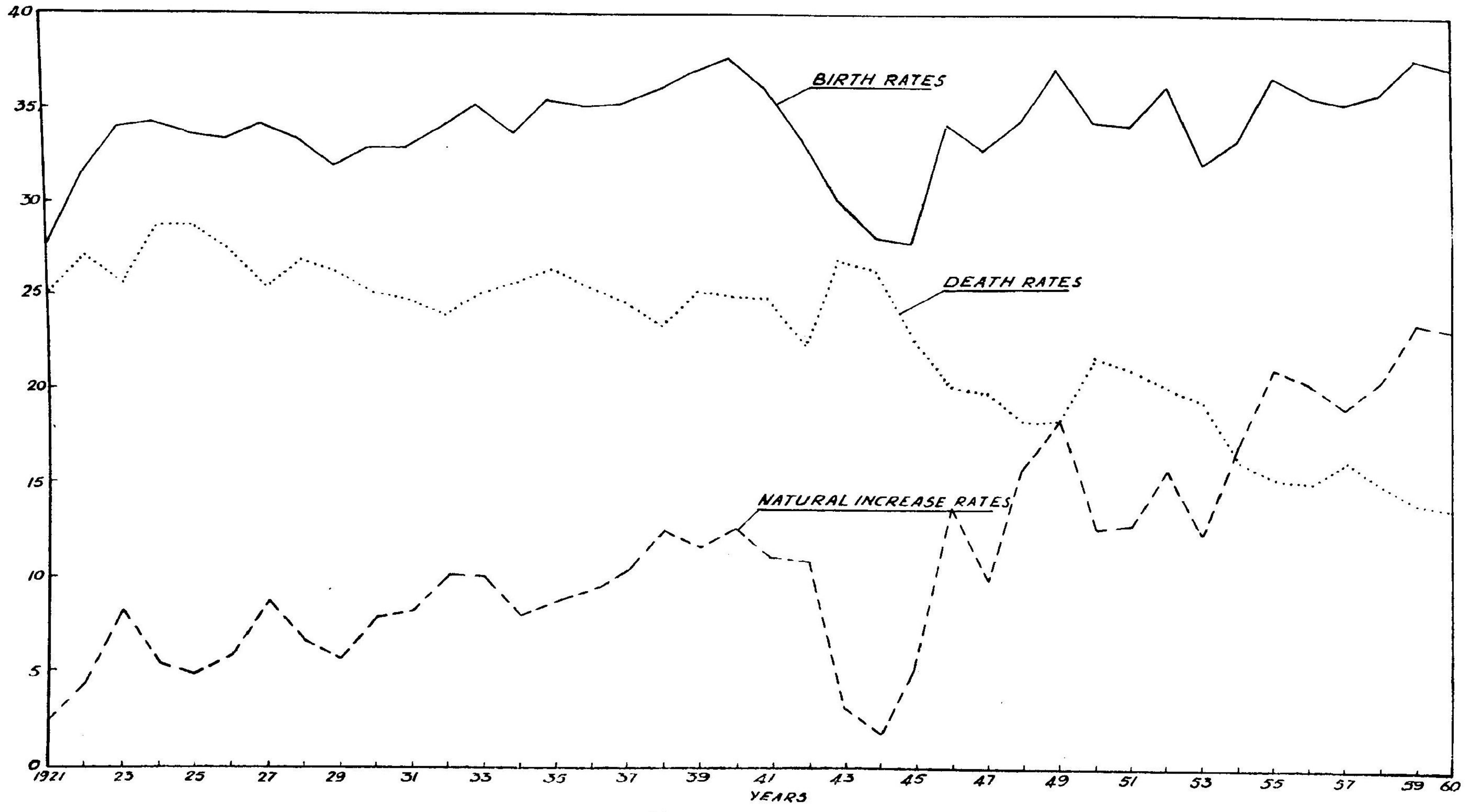
BIRTH, DEATH AND NATURAL INCREASE RATES FOR MADRAS STATE, 1921-60



BIRTH, DEATH AND NATURAL INCREASE RATES FOR RURAL AREAS, 1921-1960



BIRTH, DEATH AND NATURAL INCREASE RATES FOR URBAN AREAS, 1921-1960



out separately for males and females. The results obtained by both the methods are given in Table 2–10.

TABLE 2–10

Kingsley Davis' Estimates of Birth-Rates, 1926-30

Province or State		By reverse survival method 1926–30	Successive approximation 1926–30
British India	...	45.19	41.29
Ajmer-Merwara	...	46.31	...
Baroda	...	44.67	...
Bombay	...	44.46	41.75
Central Provinces and Berar		45.83	47.29
Coorg	...	32.93	33.78
Hyderabad	...	50.40	...
Madras	...	41.93	38.71
Mysore	...	40.70	...
Punjab	...	47.11	42.76
Travancore	...	50.84	...
United Provinces	...	46.32	40.66

Source : Kingsley Davis' the Population of India and Pakistan, p. 244.

Kingsley Davis has himself pointed out that the Reverse Survival Method probably gives too low an estimate of under-registration, because of the under-enumeration of children in the census, but it is the best technique available. It gives higher estimates of under-registration than the latter method but in most cases the difference is not more than 10%.

6. *Estimates of the National Sample Survey*

In the Fourteenth Round of the National Sample Survey in July 1958 to July 1959, information on births and deaths were also obtained in respect of members who were normally residents of the selected households. In the first two sub-rounds, detailed particulars of persons normally resident in the household were taken such as relationship to head of household, marital status, activity status, etc. For births, the age of the mother, sex of the child, mode of determination of the time of birth, place of birth, type of attendance, etc. and for deaths, month and year of death, sex, age at death, medical attendance if any, are recorded. In contrast to the first two sub-rounds, only a brief schedule was canvassed in the third to sixth sub-rounds. The number of births and deaths in the household was recorded with the month of event for the two years preceding the date of the survey but the figures for only the year preceding the date of the survey have been taken into account for working out the rates given in the report. Estimates of birth and death-rates and of the balance of births over deaths, that is the rate of natural increase were obtained for each of the six sub-rounds. The figures are given in Table 2–11.

TABLE 2–11

Birth, Death and Natural Increase Rates (National Sample Survey 14th Round, 1958–59)

Sub-Round			Birth-Rate			Death-Rate			Natural Increase Rate			Infant Death-Rate		
			Sample 1	Sample 2	Com-bined sample	Sample 1	Sample 2	Com-bined sample	Sample 1	Sample 2	Com-bined sample	Sample 1	Sample 2	Com-bined sample
1	...	...	32.83	36.14	34.21	11.52	13.95	12.54	21.31	22.19	21.67	71	137	100
2	...	...	34.58	33.62	34.17	18.60	9.38	14.62	15.98	24.24	19.55	123	55	94
3	...	...	36.88	27.99	32.03	12.75	15.20	14.09	24.13	12.79	17.94	47	103	74
4	...	...	34.20	32.26	32.90	17.85	12.85	14.48	16.35	19.41	18.42	110	58	76
5	...	...	35.25	36.92	35.98	13.66	13.35	13.53	21.59	23.57	22.45	105	97	102
6	...	...	35.14	40.18	38.51	12.37	15.87	14.71	22.77	24.31	23.80	83	103	97
All	...	...	34.94	34.19	34.55	14.14	13.81	13.97	20.80	20.38	20.58	87	94	91

Source : The National Sample Survey 14th Round, Preliminary Estimates of Birth and Death-Rates and of the Rate of Growth of Population, pp. 43–45.

It was found that the birth as well as death-rate for Madras State was lower than that of India. For rural India as a whole, the birth-rate for the reference period July 1957—July 1959, came out at 38.3 per thousand and the death-rate at 19.0 per thousand and the rate of natural increase at 1.92% per year. The corresponding rates for Madras State were 34.55, 13.97 and 2.05% respectively. It was also found that the birth-rate for India had remained at the level of 38–40 per thousand but the death-rate had declined from 24 in National Sample Survey 7th round (1953–54) through 21 in National Sample Survey 9th–10th rounds to 19.0 in National Sample Survey 14th round. The corresponding figures for different States were not worked out.

The infant death-rate, that is the number of children who were born within the reference period of one year preceding the survey and who were dead at the time of the survey came out at 113 at the All-India rural level. The corresponding figure for Madras State is found to be 91 per thousand live births. The results of the National Sample Survey serve as an external evidence on the vital rates of Madras State and are useful for purposes of comparison with those obtained from registration data.

7. *The ad hoc census as a test of registration*

The object of the ad hoc Census conducted in 1962 was to estimate the mid-year population of 1962. But incidentally it provided useful information regarding the extent of under-registration of births and deaths in non-municipal areas of the State. A comparative picture of the birth and death-rates for non-municipal areas in 1961 and those obtained from the ad hoc census can be had from the following Table.

TABLE 2–12

Comparison of Registration Rates for Non-municipal Areas with Ad hoc Census Rates

District		Registration Rates for Non-municipal areas, 1962		Ad hoc Census Rates	
		Birth rate	Death rate	Birth rate	Death rate
Chingleput	...	24.0	12.7	31.5	16.5
North Arcot	...	27.5	20.6	30.0	15.6
South Arcot	...	21.3	15.9	29.7	17.6
Salem	...	21.3	9.1	24.7	11.1
Coimbatore	...	19.8	9.5	21.5	11.0
Nilgiris	...	23.8	6.1	27.4	9.4
Madurai	...	24.4	11.4	27.8	13.2
Tiruchirapalli	...	23.3	10.9	25.4	15.0
Thanjavur	...	20.9	11.2	31.0	14.0
Ramanathapuram		21.5	9.7	29.4	12.7
Tirunelveli	...	28.4	15.5	30.9	17.9
Kanyakumari	...	27.0	10.3	33.0	12.0
State	...	23.2	12.4	27.6	14.0

It is clear that the registered rates for rural areas are comparatively lower than the ad hoc census rates which clearly show that more births and deaths were detected during the ad hoc census than is usually done by the registration staff. This is also seen from the following figures of percentage of unregistered events detected :

		Births	Deaths
1960	...	1.4	0.5
1961	...	1.2	0.6
Ad hoc Census	...	10.5	9.5

The percentage of unregistered events detected in the ad hoc census is very high when compared to that in 1960 and 1961. Moreover the extent of unregistered births is as high as unregistered deaths. This shows that registration of deaths is no better than registration of births. The percentage of births and deaths detected to total births (recorded and detected) in each district is given in Table 2–13.

TABLE 2–13

Percentage of Detected Events to Total Events

		Births	Deaths
Chingleput	...	5.65	4.08
North Arcot	...	7.12	6.16
South Arcot	...	16.03	16.53
Salem	...	13.12	10.45
Coimbatore	...	9.42	9.02
Nilgiris	...	13.98	18.08
Madurai	...	11.19	9.67
Tiruchirapalli	...	10.43	8.75
Thanjavur	...	6.31	5.29
Ramanathapuram	...	14.78	12.41
Tirunelveli	...	11.65	11.11
Kanyakumari	...	3.12	2.94
State	...	10.49	9.45

The percentage of births detected is highest in South Arcot (16.03%), Ramanathapuram (14.78%), Nilgiris (13.98%) and Salem (13.12%). In the case of deaths Nilgiris (18.08%), South Arcot (16.53%), Ramanathapuram (12.4%) and Salem (10.45%) have the highest percentages of the deaths detected. This does not mean that all the unregistered events were detected. This only shows how a large number of events can be detected with a little additional effort.

TABLE 2-14

Results of the Ad hoc Census

Development district/taluk	Estimated mid-year population for 1962 (Rounded to nearest hundred)	Estimated births for 1962	Estimated deaths for 1962	Birth-rate per 1,000 of estimated population in Column (2)	Death-rate per 1,000 of estimated population in Column (2)
1	2	3	4	5	6
Chingleput :					
Ponneri	235,600	7,407	3,821	31.4	16.2
Tiruvellore*	......	......	......	......	......
Sriperumbudur	241,100	8,703	4,170	33.5	17.3
Saidapet*	......	......	......	......	......
Kancheepuram* ...	......	......	......	......	......
Chingleput	224,600	6,482	3,758	28.9	16.7
Madurantakam	288,400	9,168	4,538	31.8	15.7
Tiruttani*	......	......	......	......	......
North Vellore :					
Tirupattur	344,400	11,645	4,224	33.8	12.3
Gudiyatham	341,800	9,884	4,138	28.9	12.1
Vellore	260,500	8,100	3,837	31.1	14.7
Walajah	306,400	8,630	4,359	28.2	14.2
Arkonam	227,100	6,748	3,557	29.7	15.7
South Vellore :					
Cheyyar	212,800	5,977	3,848	28.1	18.1
Arni	140,400	4,184	2,669	29.8	19.0
Wandiwash	224,500	6,500	4,117	29.0	18.3
Tiruvannamalai... ...	216,400	6,466	3,506	29.9	16.2
Chengam	225,900	6,800	4,329	30.1	19.2
Polur	250,300	7,705	4,210	30.8	16.8
North Cuddalore :					
Tirukoilur	403,100	13,107	9,599	32.5	23.8
Villupuram*	......	......	......	......	......
Tindivanam*	......	......	......	......	......
Ginjee	258,100	7,175	4,357	27.8	16.9
South Cuddalore :					
Cuddalore*	......	......	......	......	......
Chidambaram	402,500	13,282	5,527	33.0	13.7
Vridhachalam*	......	......	......	......	......
Kallakurichi	387,500	9,518	6,105	24.6	15.8
North Salem :					
Hosur	355,900	8,702	3,809	24.5	10.7
Krishnagiri	427,100	11,900	4,350	27.9	10.2
Dharmapuri	383,900	10,055	3,569	26.2	9.3
Harur	221,300	6,566	2,268	29.7	10.2
Omalur*	......	......	......	......	......
South Salem:					
Attur	301,300	8,400	3,928	27.9	13.0
Salem	374,100	8,925	3,851	23.9	10.3
Yercaud	24,100	543	242	22.5	10.0
Namakkal	424,400	9,100	5,993	21.4	14.1

TABLE 2-14—*contd.*

Results of the Ad hoc Census—*contd.*

Development district/taluk		Estimated mid-year population for 1962 (Rounded to nearest hundred)	Estimated births for 1962	Estimated deaths for 1962	Birth-rate per 1,000 of estimated population in Column (2).	Death-rate per 1,000 of estimated population in Column (2)
1		2	3	4	5	6
South Salem—(contd.)						
Rasipuram	...	179,300	4,164	2,392	23.2	13.3
Tiruchengode	...	248,800	4,536	2,734	18.2	11.0
Sankari	...	246,800	5,673	2,319	23.0	9.4
East Coimbatore :						
Gobichettipalayam	...	382,400	10,364	4,944	27.1	12.9
Bhavani	...	258,000	6,545	2,272	25.4	8.8
Dharapuram	...	299,600	6,545	3,573	21.8	11.9
Erode	...	442,400	8,629	5,156	19.5	11.7
West Coimbatore :						
Coimbatore	...	447,000	6,885	3,669	15.4	8.2
Avanashi	...	262,300	6,075	3,282	23.2	12.5
Pollachi	...	369,900	7,480	4,012	20.2	10.8
Tiruppur (Palladam)	...	314,100	6,500	3,247	20.7	10.3
Udumalpet	...	196,100	4,959	2,429	25.3	12.4
The Nilgiris :						
Gudalur	...	67,500	1,880	793	27.9	11.7
Ootacamund	...	122,600	3,536	1,242	28.8	10.1
Coonoor	...	146,700	3,814	1,128	26.0	7.7
North Madurai :						
Dindigul	...	514,600	15,973	8,431	31.0	16.4
Kodaikanal	...	51,800	1,586	802	30.6	15.5
Palani	...	246,900	5,836	3,009	23.6	12.2
Nilakottai	...	299,100	10,009	3,956	33.5	13.2
South Madurai :						
Madurai	...	247,800	4,527	2,545	18.3	10.3
Melur	...	246,400	6,159	3,175	25.0	12.9
Periyakulam	...	553,800	15,680	6,030	28.3	10.9
Tirumangalam	...	418,300	11,907	6,070	28.5	14.5
North Tiruchirapalli :						
Musiri	...	376,600	10,991	5,774	29.2	15.3
Lalgudi	...	269,700	6,586	3,921	24.4	14.5
Perambalur	...	290,900	7,977	4,888	27.4	16.8
Udayarpalayam	...	444,700	12,925	7,834	29.1	17.6
Tiruchirapalli	...	212,600	3,491	2,124	16.4	10.0
South Tiruchirapalli :						
Karur	...	297,300	5,559	3,830	18.7	12.9
Kulithalai	...	447,800	13,973	7,786	31.2	17.4
Kulathur	...	171,200	3,582	2,191	20.9	12.8
Alangudi	...	150,800	3,136	2,154	20.8	14.3
Tirumayam	...	165,000	3,557	1,984	21.6	12.0

TABLE 2-14—(*Contd.*)

Results of the Ad hoc Census—(*Contd.*)

Development district/taluk	Estimated mid-year population for 1962 (Rounded to nearest hundred)	Estimated births for 1962	Estimated deaths for 1962	Birth rate per 1,000 of estimated population in Column (2)	Death rate per 1,000 of estimated population in Column (2)
1	2	3	4	5	6
East Thanjavur :					
Mannargudi* ...	......	......	......	......	......
Thiruthuraipoondi* ...	......	......	......	......	......
Mayuram ...	321,400	10,370	4,002	32.3	12.5
Sirkali ...	192,400	7,675	2,788	39.9	14.5
Nagapattinam ...	193,500	5,943	3,231	30.7	16.7
Nannilam ...	274,700	9,832	4,117	35.8	15.0
West Thanjavur :					
Thanjavur* ...	......	......	......	......	......
Orathanad* ...	......	......	......	......	......
Pattukottai ...	295,200	6,373	3,061	21.6	10.4
Aranthangi* ...	......	......	......	......	......
Kumbakonam ...	280,200	8,020	4,529	28.6	16.2
Papanasam* ...	......	......	......	......	......
East Ramanathapuram :					
Tirupattur ...	319,600	7,459	2,979	23.3	9.3
Sivaganga ...	271,100	6,891	3,424	25.4	12.6
Tiruvadanai ...	232,600	8,125	2,572	34.9	12.3
Paramakudi* ...	......	......	......	......	......
Mudukulathur* ...	......	......	......	......	......
Ramanathapuram ...	171,400	6,589	2,096	38.4	12.2
West Ramanathapuram :					
Sattur* ...	......	......	......	......	......
Srivilliputhur ...	234,800	7,045	4,238	30.0	18.0
Aruppukottai* ...	......	......	......	......	......
North Tirunelveli :					
Srivaikuntam ...	209,100	5,643	3,841	27.0	18.4
Tiruchendur ...	297,300	7,845	4,198	26.4	14.1
Sankarankoil ...	340,900	9,557	5,273	28.0	15.5
Koilpatti ...	420,900	14,538	8,579	34.5	20.3
South Tirunelveli :					
Tirunelveli ...	162,600	4,491	2,797	27.6	17.2
Tenkasi ...	343,200	12,539	6,900	36.5	20.1
Shencottah ...	47,200	2,114	1,207	44.8	25.6
Nanguneri ...	331,300	9,314	4,972	28.1	15.0
Ambasamudram ...	298,300	9,750	6,152	32.7	20.6
Kanyakumari :					
Agastheeswaram ...	176,500	6,789	2,445	38.5	13.9
Vilavancode ...	311,900	9,445	3,240	30.3	10.4
Thovala ...	64,000	2,225	932	34.8	14.6
Kalkulam ...	319,100	10,334	3,865	32.4	12.1

* Complete figures have not been received.

Percentage of under-registration

In the earlier decades, the registration was in its beginning stages and references may be found in all the earlier census reports about the deficiencies in the registration system. A comparison of the decennial rates over a period was attempted for the first time in the 1931 Census Report of Madras State where the birth and death rate for the period 1921 to 1931 have been examined in detail by Mr. Yeatts. We may therefore confine the discussion of the percentage of under registration to the later decades which have witnessed the stabilisation of the system of registration in the State. Table 2-15 summarises the registration coverage in percentage derived from these estimates.

TABLE 2-15

Registration coverage in percentage at different periods

Period		Percentage of registration	Author
Births :			
1926-30	...	83.9	Kingsley Davis.
1941-50	...	88.8	Jain.
1951-60	...	77.6	
Deaths :			
1941-50	...	90.4	Jain
1951-60	...	63.1	„

Though these figures are not strictly comparable, they can be taken as indicative of the broad magnitude of the error in the registration rate. The extent of under registration even if we make allowance for differences in the method, appears to be fluctuating in the different decades. The last decade, for instance, appears to have experienced a decline in the efficiency of registration to the level of the early 1920s. We may however examine other evidences before accepting the above inference as correct.

According to para 4 of the Boards' Standing Order No. 101, it is the duty of the Tahsildar, Deputy Tahsildar and Revenue Inspectors to scrutinise the registers during their tours and to verify a certain number of entries by local enquiry and to punish or bring to notice any instances of neglect on the part of the village officers. Another excellent check prescribed by the Board is that a trustworthy official should be deputed to take a census of all children in a village under one year of age and to compare the results with the register of births.

Under Section 15 of the Madras Registration of Births and Deaths Act, 1899 it shall be the duty of every registrar to inform himself carefully of every birth and of every death, which takes place in the area under his jurisdiction and he should make frequent enquiries so as to make the entries complete and correct.

Under the Public Health Code (Vol. I) it is the duty of the Health Inspector to inspect the birth and death registers of the villages he visits and check their completeness and accuracy by house to house enquiry, as far as possible.

In municipalities and Panchayats, where Sanitary Inspectors are employed, they should help in the work of registration of births and deaths by enquiry during their inspections and bring to account cases of any unregistered births and deaths detected. One of the duties of the Municipal Health Officer is to institute necessary measures to ensure accurate registration of births and deaths. In municipalities which do not employ separate Health Officers, the District Health Officer shall scrutinise the returns of vaccination and vital statistics, and take such action as he considers necessary, for remedying any defects.

Table 2-16 shows the number of unregistered births and deaths detected by the health staff in municipal and non-municipal areas during 1956 to 1960.

The figures for the earlier years are not available for the present Madras State and therefore it has not been possible to attempt a comparison over a longer period. The percentage of unregistered deaths detected is greater than that of births in municipal areas, whereas it is low in non-municipal areas. The fact that the number of events detected is less in non-municipal areas does not imply that the registration is more complete in non-municipal than in municipal areas. The discussion in later part of this chapter will show that it is in fact the opposite. The above argument only shows the poorer detection work of the health staff in non-municipal areas than in municipal areas.

Many deaths in non-municipal areas escaped registration probably due to the fact that there is no effective arrangement for disposal of dead bodies in rural areas. The report on health conditions in Madras State for 1960 points out that several deaths escaped registration even in municipal areas due to this reason. If the relevant provisions relating to the burial and burning grounds in the Madras District Municipalities Act were strictly enforced it should be possible to ensure greater percentage of registration of deaths. As per

Section 282 of the Act, the Executive Authority should appoint an officer to whom the persons having control of a place for disposing of the dead shall give information. It is reported that only 12 municipalities implemented this provision in 1960.

The village birth and death Registrars who are generally the village munsiffs forward the monthly returns of births and deaths to the Tahsildars who in turn forward them to the Director of Public Health, Madras. Statutory provisions lay down that returns should be submitted by the Registrars by the third of the month following the month to which the returns relate. The Tahsildars are required by executive instructions to forward all the returns by the eighth of the subsequent month. In spite of these instructions the submission of returns by many Tahsildars appears to be unsatisfactory. The number of returns not received and the number due from each district for 1956 to 1960 are given in Table 2–17.

It is not clear why the number of returns due from each district should be changing year after year, when there is no change in the set up of the villages in the State. Further, the percentage of non-receipt of returns has been changing year after year and from district to district. For the State as a whole the percentage is 5.8 in 1960 as against 5.4, 8.3 and 6.8 in 1959, 1958 and 1957 respectively. In 1960, the maximum default has occurred in South Arcot and Nilgiris Districts (with 11.1%) closely followed by Ramanathapuram District (10%). Invariably, Kanyakumari District has shown no default. Apart from the registration of vital events the timely receipt of the returns by the Director of Public Health is important if the chain of the vital statistics compilation has to be completed. Under Section 18 (*b*) of the Act III of 1899 the Collectors ought to take action against the village munsiffs who failed to submit the returns in time, but normally no action is taken by them. It is unfortunate that even after registration, the coverage of the vital statistics should be incomplete due to the default of the village munsiffs in the submission of the returns.

Correction of vital rates by the D. P. H.

The consolidated figures of births as well as deaths suffer from errors due to under registration and incomplete coverage in compilation of recorded events in rural areas. The Director of Public Health, Madras has attempted a 'correction' for the incomplete coverage in compilation, ignoring the effect of the other factor. This is obtained by inflating the registered rates by the percentage of returns not received. The recorded and corrected birth and death rates worked out by the Director of Public Health are given in Table 2–18.

TABLE 2–16

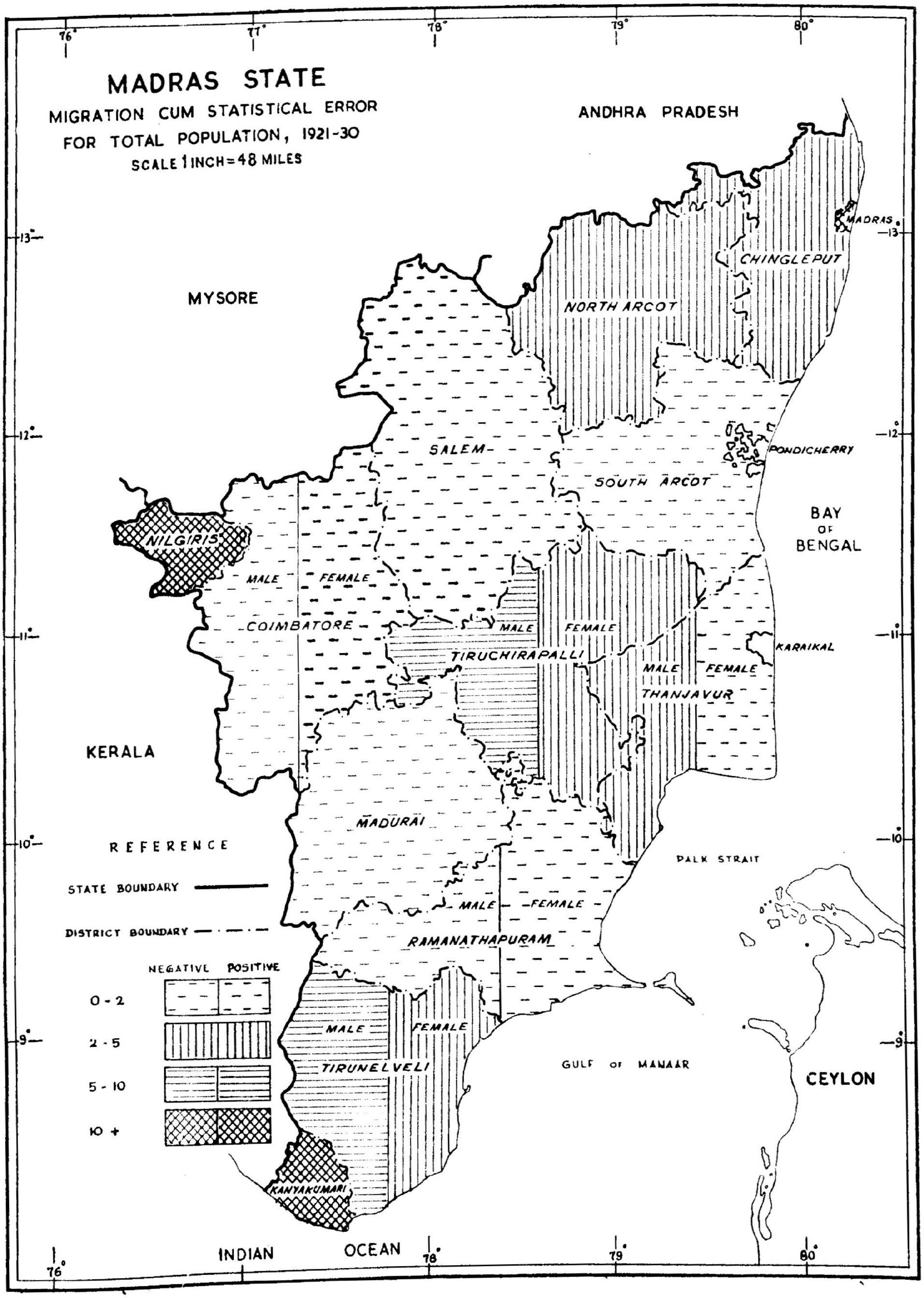
Unregistered events detected by Health Staff

	Births	Deaths	Births	Deaths	Births	Deaths	Births	Deaths	Births	Deaths
1. *Unregistered events detected :*										
Municipal ...	38,370	9,214	10,969	2,415	17,890	11,807	11,783	6,235	17,700	8,083
Non-municipal ...	3,926	3,011	6,100	3,852	15,954	3,625	9,364	1,697	8,887	1,586
Total ...	42,296	12,225	17,069	6,267	33,844	15,432	21,147	7,932	26,587	9,669
2. *Percentage to total registration :*										
Municipal ...	17.6	9.9	4.9	2.4	7.8	12.2	4.9	6.7	7.1	8.6
Non-municipal ...	0.6	0.9	0.7	1.1	2.4	1.2	1.3	0.6	1.4	0.5
Total ...	4.7	2.8	2.0	1.4	3.8	3.6	2.2	2.0	3.0	2.4

TABLE 2-17

Monthly returns of births and deaths due from Tahsildars

District	1956			1957			1958			1959			1960		
	No. due	No. not received	% default	No. due	No. not received	% default	No. due	No. not received	% default	No. due	No. not received	% default	No. due	No. not received	% default
Chingleput ...	26,076	1,762	6.8	26,076	2,835	10.9	25,212	1,245	4.9	25,188	812	3.2	26,241	1,566	5.9
North Arcot ...	24,324	1,564	6.4	24,324	1,027	4.2	24,324	790	4.1	24,312	736	3.0	24,252	1,703	7.0
South Arcot ...	27,204	2,503	9.2	27,204	3,910	14.4	27,204	7,525	27.7	27,204	2,314	8.5	27,204	3,090	11.4
Salem ...	19,383	1,505	7.8	19,392	1,016	6.2	19,392	872	4.5	19,392	803	4.1	19,363	858	4.4
Coimbatore ...	13,320	387	2.9	13,320	444	3.3	13,320	819	6.2	13,176	300	2.3	13,176	645	4.9
Nilgiris ...	2,284	213	9.3	2,076	227	10.9	2,064	288	14.0	1,920	222	11.6	1,872	207	11.1
Madurai ...	12,852	1,307	10.2	12,852	938	7.3	12,852	1,355	10.5	12,820	1,549	12.1	12,816	165	1.3
Tiruchirapalli ...	19,296	1,374	7.1	19,296	921	4.8	19,296	538	2.8	19,296	514	2.7	19,296	828	4.3
Thanjavur ...	30,240	1,702	5.6	29,916	570	1.9	29,808	997	3.3	29,148	2,657	9.1	29,148	936	3.2
Ramanatha-puram ...	18,336	2,991	16.3	18,336	2,000	10.9	18,335	2,375	13.0	18,336	1,126	6.1	18,336	1,835	10.0
Tirunelveli ...	13,044	26	9.2	13,135	133	1.0	13,164	112	0.9	13,260	255	1.9	13,255	200	1.5
Kanyakumari ...	900	...	...	792	...	...	792	1	0.1	912	...	...	912	...	...
State ...	207,259	15,334	7.4	206,719	14,021	6.8	205,754	17,117	8.3	207,964	11,288	5.4	206,051	12,033	5.8



MADRAS STATE
MIGRATION CUM STATISTICAL ERROR
FOR TOTAL POPULATION, 1921-30
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
PONDICHERRY
SOUTH ARCOT
BAY OF BENGAL
NILGIRIS
MALE
FEMALE
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
MADURAI
PALK STRAIT
RAMANATHAPURAM
TIRUNELVELI
GULF OF MANAAR
CEYLON
KANYAKUMARI
INDIAN OCEAN
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
NEGATIVE
POSITIVE
0 - 2
2 - 5
5 - 10
10 +
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°

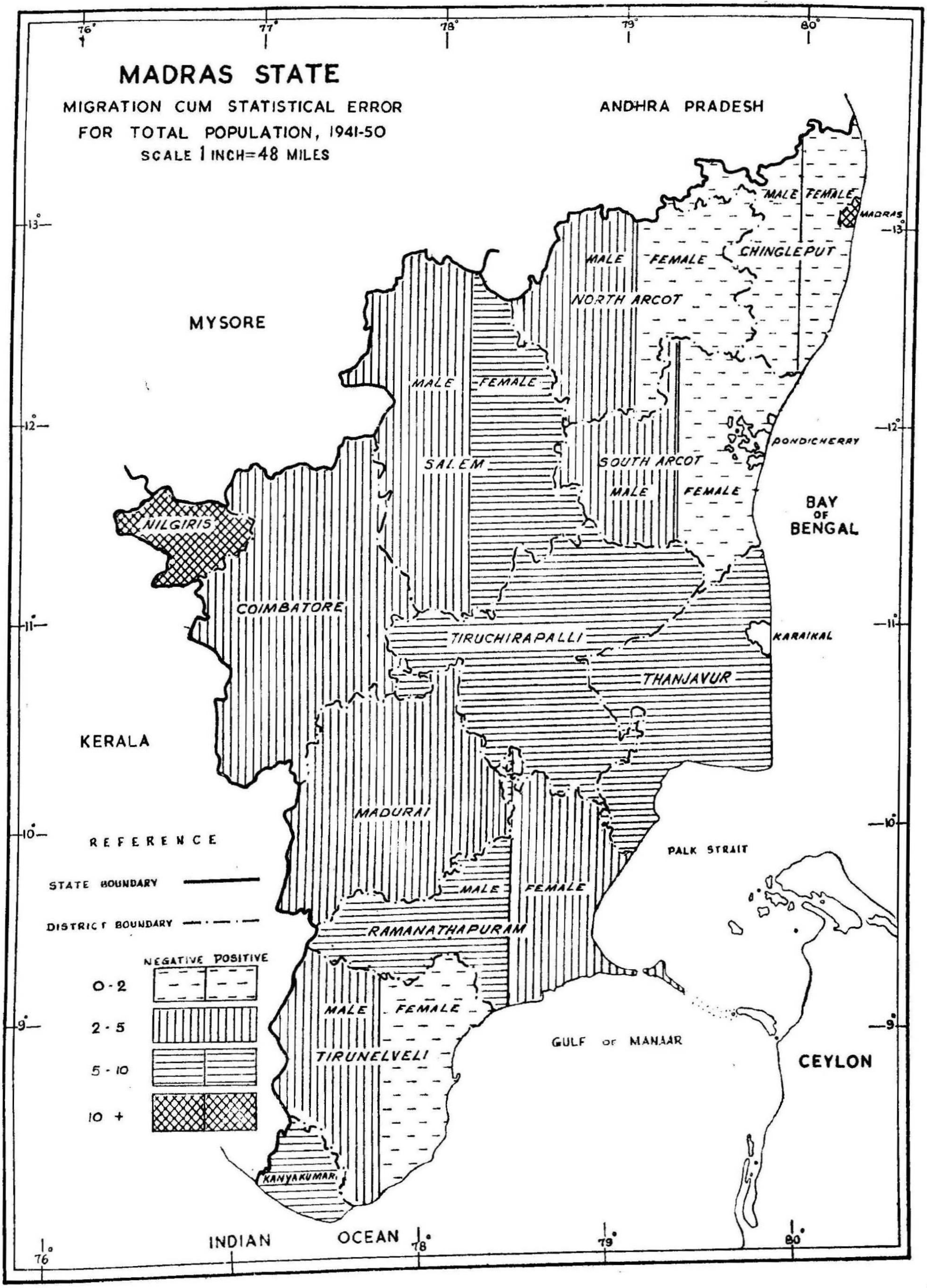

MADRAS STATE
MIGRATION CUM STATISTICAL ERROR
FOR TOTAL POPULATION, 1941-50
SCALE 1 INCH=48 MILES
ANDHRA PRADESH
MYSORE
KERALA
BAY OF BENGAL
PALK STRAIT
GULF OF MANAAR
CEYLON
INDIAN OCEAN
MADRAS
PONDICHERRY
KARAIKAL
CHINGLEPUT
NORTH ARCOT
SOUTH ARCOT
SALEM
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
THANJAVUR
MADURAI
RAMANATHAPURAM
TIRUNELVELI
KANYAKUMARI
MALE
FEMALE
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
NEGATIVE POSITIVE
0-2
2-5
5-10
10 +
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°

TABLE 2–18

Recorded and corrected Birth and Death Rates

Year		Birth Rate		Death Rate	
		Recorded	Corrected	Recorded	Corrected
1950	...	29.0	29.3	19.7	19.9
1951	...	25.7	26.6	17.1	17.6
1952	...	27.5	28.1	16.0	16.4
1953	...	25.2	25.6	17.2	17.6
1954	...	26.3	26.9	14.0	14.4
1955	...	31.0	31.6	14.3	14.6
1956	...	27.8	30.1	13.6	14.5
1957	...	26.7	28.2	14.2	14.9
1958	...	27.0	28.8	13.1	14.0
1959	...	28.5	29.7	11.9	12.5
1960	...	26.7	27.8	12.1	12.7

It is seen that the improvement in the rate on account of the 'correction' is only marginal, whereas the major source of error, *viz.*, under registration still remains unaccounted for. Another defect in this method is the basis of correction, *viz.*, the ratio of the number of returns due to the number received. The concept of 'returns due' is rather an ambiguous one, covering within its fold areas of all sizes and magnitudes. For instance a village with a population of 300 and another with a population of 100 get an equal status since each will have only one return. The correct basis should be the ratio of the population of the area for which returns are due to that of the area for which returns are received.

Registration error

Theoretically, one should expect that the growth of population as estimated from two successive censuses after making due allowance for migration should be equal to the excess of births over deaths as revealed by vital statistics. Symbolically, the balancing equation

$$G = B - D + I - O$$

where, G : the variation in population

B : births

D : deaths

I : in-migration

O : out-migration

will be satisfied if our vital registration data and census data are correct. The first test of accuracy of vital statistics data is to compare the mean decennial growth rate with the rate of natural increase. If the intercensal rate of growth is correct, the difference, if any, must be due to migration-cum-statistical error. Table 2–19 gives the migration-cum-statistical error for all areas by sex for 1921–30, 1931–40, and 1941–50 and for total, rural and urban areas for 1951–60.

TABLE 2–19

Migration-Cum-Statistical Error by Sex for 1921–30 to 1951–60

District			1921-30		1931-40		1941-50	
			Males	Females	Males	Females	Males	Females
Madras	...	...	19.7	18.8	11.2	11.9	31.9	31.7
Chingleput	...	...	— 3.1	— 3.2	— 2.0	— 2.8	— 0.4	— 0.03
North Arcot	...	...	— 2.3	— 2.3	— 3.3	— 3.5	— 2.0	— 0.006
South Arcot	...	...	— 1.4	— 1.9	— 3.8	— 4.0	— 2.5	— 0.7
Salem	...	...	0.6	1.7	1.4	1.2	4.0	5.1
Coimbatore	...	...	— 0.3	0.2	— 1.2	— 1.5	2.0	3.0
Nilgiris	...	...	26.0	19.7	11.0	10.2	21.3	23.4
Madurai	...	...	— 0.9	— 0.5	— 0.066	— 0.4	4.6	4.6
Tiruchi	...	...	— 6.2	— 4.7	2.9	2.2	5.2	5.4
Thanjavur	...	...	— 2.7	0.04	0.2	0.2	9.1	9.1
Ramanathapuram	...	...	— 1.3	0.08	— 3.1	— 2.7	— 7.3	— 4.7
Tirunelveli	...	...	— 5.4	— 2.0	— 3.1	— 2.8	— 2.2	— 0.1
Kanyakumari	...	...	11.5	12.2	5.4	5.7	6.3	5.9
State	...	...	— 0.9	— 0.09	— 0.4	— 0.6	3.3	4.2

TABLE 2-19—(*Contd.*)

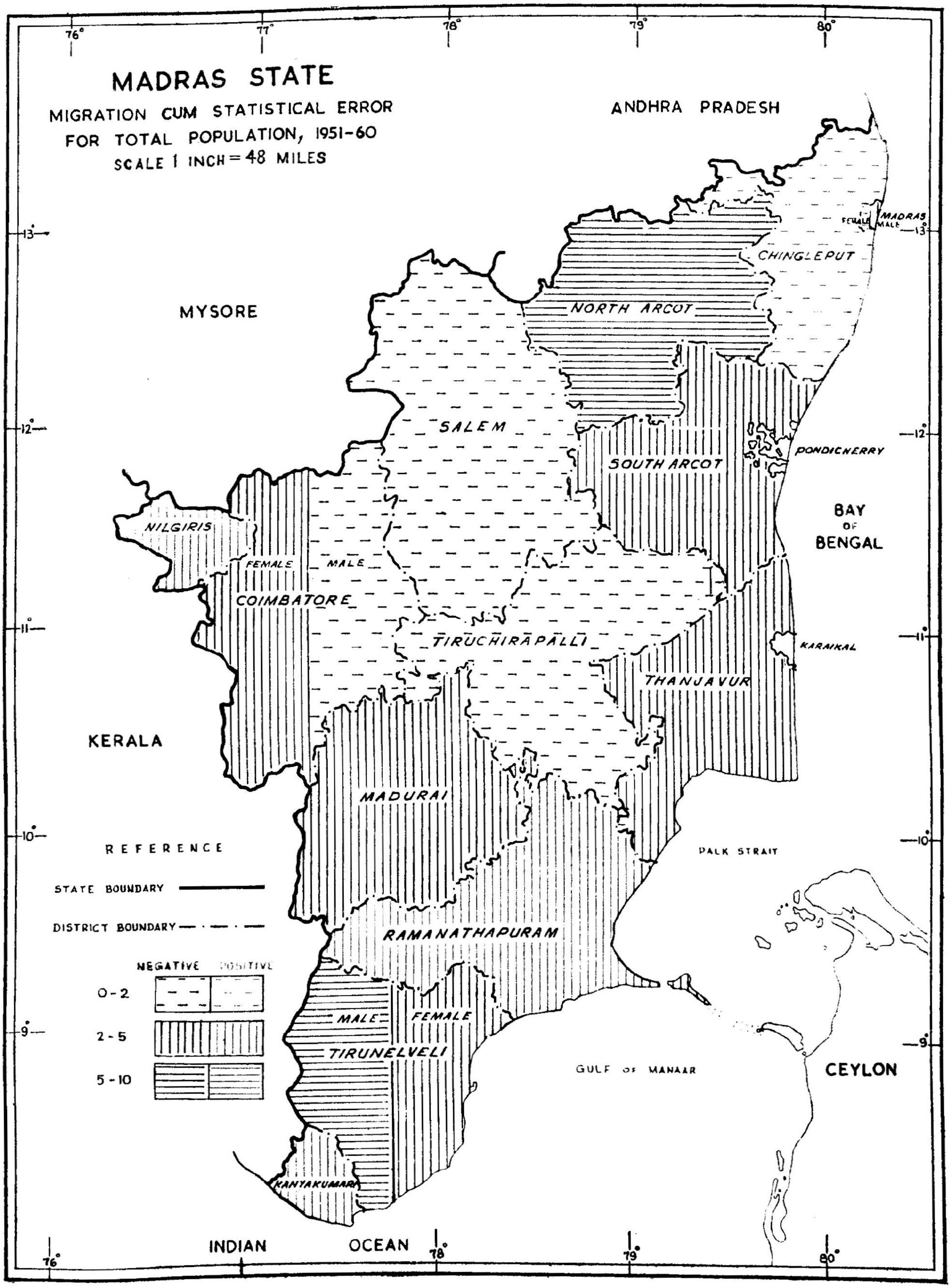
Migration-Cum-Statistical Error by Sex for 1921-30 to 1951-60—(*Contd.*)

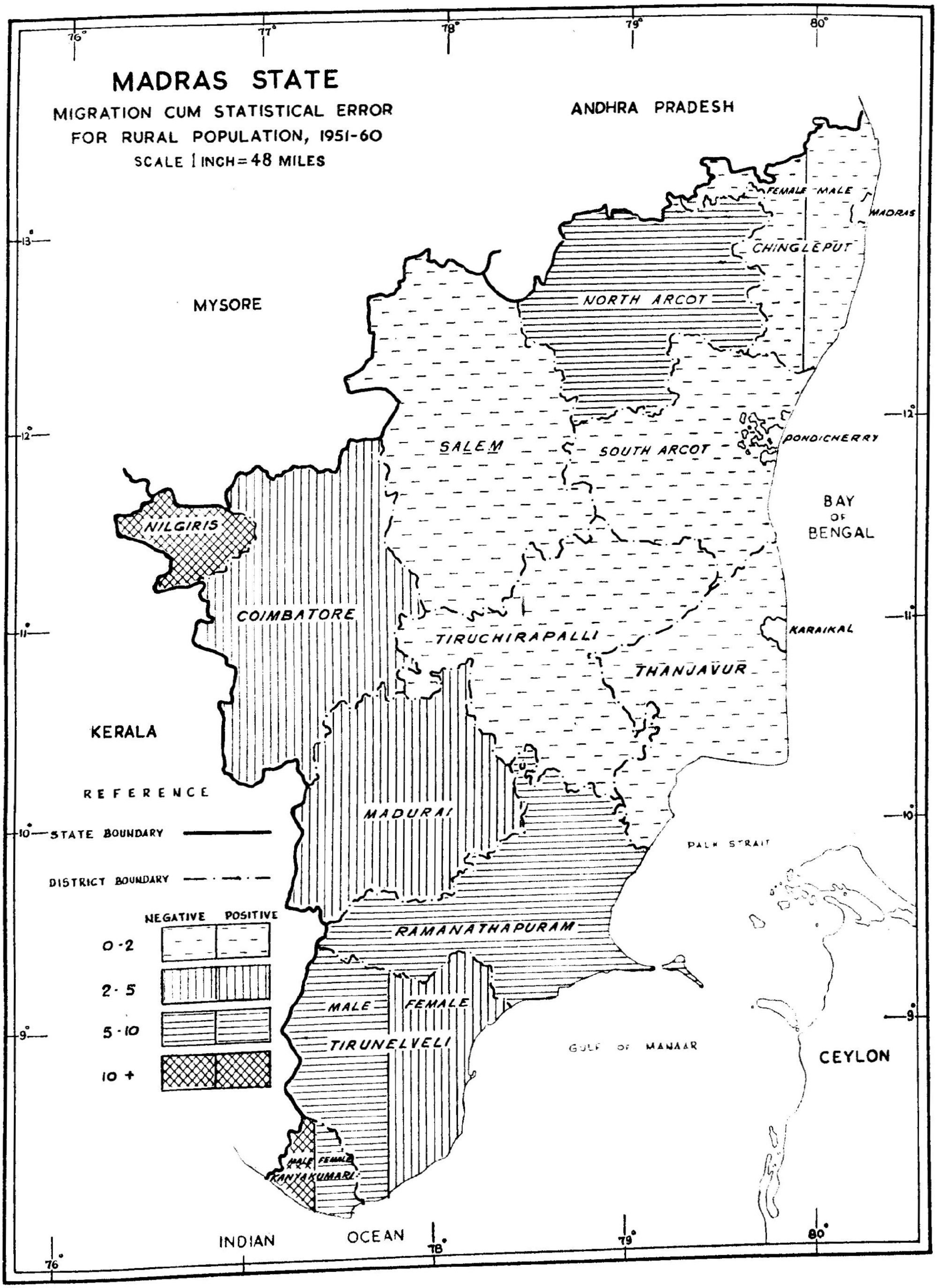
District	1951-60					
	Total		Rural		Urban	
	Males	Females	Males	Females	Males	Females
Madras	3.2	0.3	...	...	3.2	0.3
Chingleput	1.3	0.4	0.7	— 0.2	4.4	3.2
North Arcot	— 7.0	— 7.3	— 6.1	— 6.1	— 11.2	— 12.3
South Arcot	— 2.0	— 2.2	— 1.4	— 1.5	— 6.8	— 7.5
Salem	— 0.4	— 0.8	— 0.8	— 0.9	2.0	0.3
Coimbatore	— 1.2	— 2.8	— 3.1	— 4.5	4.5	3.1
Nilgiris	6.5	6.4	10.8	11.3	— 5.2	— 7.4
Madurai	— 3.1	— 2.7	— 3.3	— 2.8	— 2.5	— 2.7
Tiruchi	— 1.9	— 1.2	— 1.5	— 0.7	— 3.6	— 3.4
Thanjavur	— 2.7	— 2.3	0.3	0.7	— 15.5	— 15.2
Ramanathapuram	2.3	2.4	6.7	6.4	— 11.7	— 10.5
Tirunelveli	— 5.7	— 3.7	— 7.4	— 4.8	— 2.3	— 1.2
Kanyakumari	3.3	4.1	— 10.1	— 8.7	30.3	29.6
State	— 1.6	— 1.8	— 1.8	— 1.6	— 1.1	— 2.1

TABLE 2-20

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
1	Madras ...	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—
2	Kancheepuram ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
3	Tiruvallur ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4	Chingleput ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5	Tiruvottiyur ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×


MADRAS STATE
MIGRATION CUM STATISTICAL ERROR
FOR TOTAL POPULATION, 1951-60
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
FEMALE
MALE
CHINGLEPUT
NORTH ARCOT
SALEM
SOUTH ARCOT
PONDICHERRY
BAY OF BENGAL
NILGIRIS
FEMALE
MALE
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
MADURAI
PALK STRAIT
RAMANATHAPURAM
MALE
FEMALE
TIRUNELVELI
KANYAKUMARI
GULF OF MANAAR
CEYLON
INDIAN OCEAN
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
NEGATIVE
POSITIVE
0-2
2-5
5-10
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°


MADRAS STATE
MIGRATION CUM STATISTICAL ERROR
FOR RURAL POPULATION, 1951-60
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
SOUTH ARCOT
PONDICHERRY
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
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KARAIKAL
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TIRUNELVELI
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MALE
FEMALE
BAY OF BENGAL
PALK STRAIT
GULF OF MANAAR
CEYLON
INDIAN OCEAN
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
NEGATIVE
POSITIVE
0-2
2-5
5-10
10 +

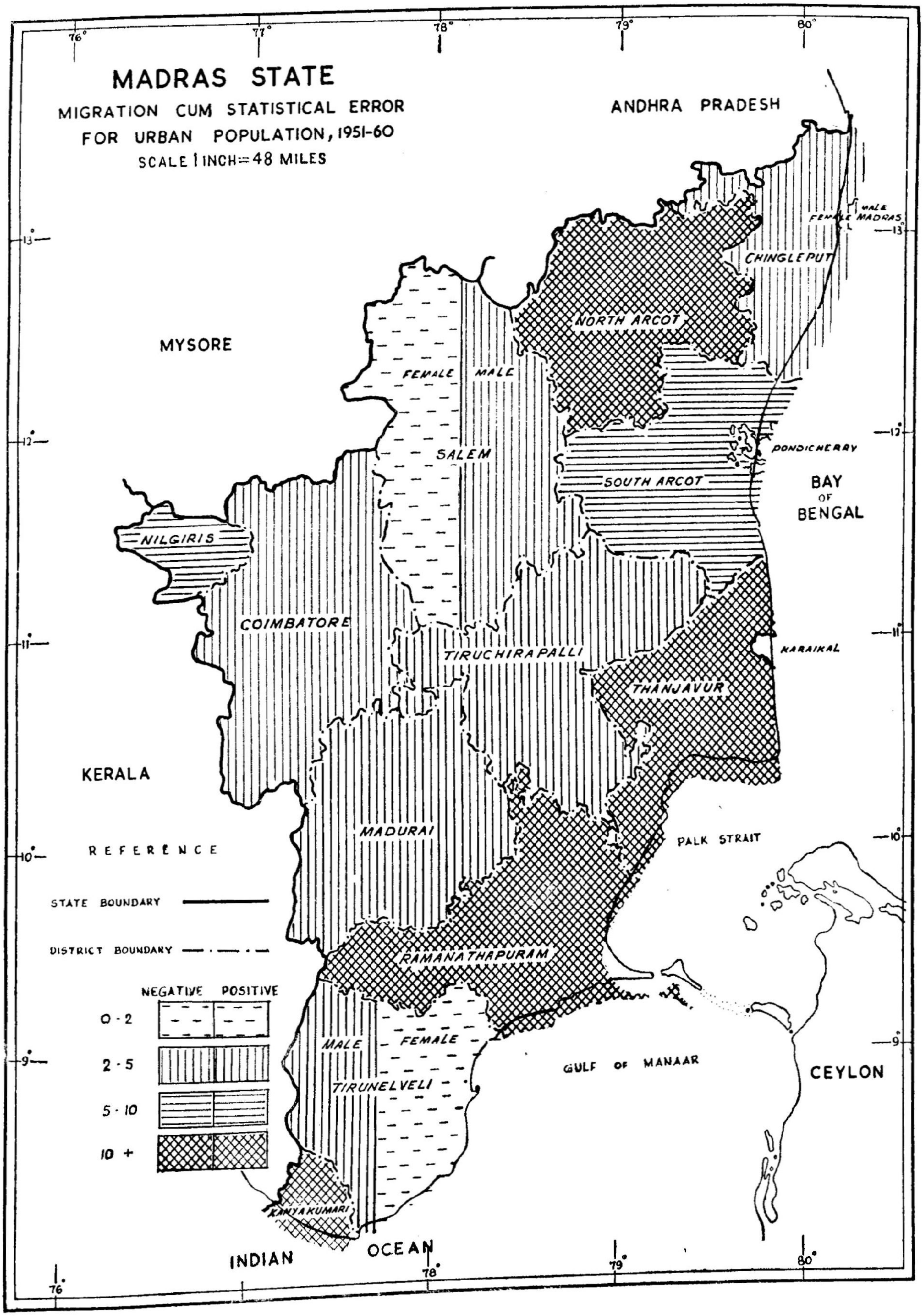

MADRAS STATE
MIGRATION CUM STATISTICAL ERROR
FOR URBAN POPULATION, 1951-60
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
FEMALE
MALE
SOUTH ARCOT
PONDICHERRY
BAY OF BENGAL
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
MADURAI
PALK STRAIT
RAMANATHAPURAM
TIRUNELVELI
KANYAKUMARI
GULF OF MANAAR
CEYLON
INDIAN OCEAN
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
NEGATIVE
POSITIVE
0 - 2
2 - 5
5 - 10
10 +
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951–60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5–10		2–5		0–2		0–2		2–5		5–10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
6	Poonamallee ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
7	Uthiramerur ...	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–
8	Alandur ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
9	Pallavaram ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
10	Tirukkalikunram ...	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–
11	Madurantakam ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
12	Walajabad ...	–	–	–	×	–	–	–	–	–	–	–	–	×	–	–	–
13	Cheyyur ...	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–
14	Arni ...	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–
15	St. Thomas Mount ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–
16	Villivakkam ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
17	Sriperumbudur ...	–	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–
18	Tambaram ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
19	Kunrathur ...	–	–	–	–	–	–	–	–	–	–	×	–	–	×	–	–
20	Ponneri ...	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–
21	Vellore ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
22	Tiruvannamalai ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
23	Gudiyatham ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
24	Vaniyambadi ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
25	Tirupattur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
26	Walajapet ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
27	Ambur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
28	Arni ...	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–
29	Arkonam ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
30	Arcot ...	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–
31	Ranipet ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
32	Tiruvottiyur ...	–	–	×	–	–	–	–	×	–	–	–	–	–	–	–	–
33	Polur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
34	Visharam ...	–	×	–	–	–	–	–	–	×	–	–	–	–	–	–	–
35	Pernampet ...	–	–	–	×	–	–	–	–	–	–	×	–	–	–	–	–
36	Sholingur ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
37	Pallikonda ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
38	Wandiwash ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
39	Kalambur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
40	Chetpet ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–
41	Kaveripakkam ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
42	Panapakkam ...	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–
43	Cuddalore ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
44	Chidambaram ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
45	Villupuram ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
46	Tindivanam ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
47	Panruti ...	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	×
48	Portonovo ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
49	Nellikuppam ...	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–
50	Tirukoilur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
51	Pennadam ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
52	Kurinjipadi ...	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–
53	Mannargudi ...	–	–	–	–	–	–	–	–	–	×	–	–	×	–	–	–

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	Negative								Positive							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
54	Vridhachalam ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
55	Bhuvanagiri ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
56	Kallakurichi ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
57	Chinna Salem ...	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
58	Valavanur ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
59	Srimushnam ...	—	—	—	×	—	—	—	—	—	—	×	—	—	—	—	—
60	Ulundurpet ...	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
61	Salem ...	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—
62	Rasipuram ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
63	Edapadi ...	—	—	—	—	—	—	—	—	×	—	—	—	—	×	—	—
64	Dharmapuri ...	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—
65	Komarapalayam ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
66	Tiruchengode ...	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—
67	Mettur Township ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
68	Taramangalam ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
69	Attur ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
70	Kaveripakkam ...	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—
71	Sendamangalam ...	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
72	Harur ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
73	Namakkal ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
74	Hosur ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
75	Jalakandapuram ...	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
76	Krishnagiri ...	—	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—
77	Omalur ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951–60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5–10		2–5		0–2		0–2		2–5		5–10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
78	Denkanikottai ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
79	Mallasamudram ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
80	Coimbatore ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
81	Erode ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—
82	Tiruppur ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
83	Pollachi ...	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—
84	Dharapuram ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
85	Udumalpet ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
86	Mettupalayam ...	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—
87	Gobichettipalayam ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
88	Kurichi ..	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
89	Kottur ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
90	Palladam ...	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
91	Bhavani ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
92	Avanashi ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
93	Vallalore ...	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—
94	Singanallur ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
95	Satyamangalam ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
96	Sulur ...	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—
97	Kuniamuthur ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
98	Peelamedu ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
99	Annur ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—
100	Anamalai ...	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
101	Vettaikaranpudur ...	—	—	—	—	—	×	—	—	—	—	—	—	×	—	—	—

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(15)	(17)	(18)
102	Ootacamund ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
103	Coonoor ...	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
104	Kotagiri ...	—	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—
105	Wellington ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
106	Madurai ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
107	Dindigul ...	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
108	Bodinayakanur ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
109	Periyakulam ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—
110	Palani ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—
111	Kodaikanal ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
112	Cumbum ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
113	Gudalur ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
114	Thovala ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
115	Chinnamanur ...	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
116	Tirumangalam ...	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
117	Uthamapalayam ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—
118	Allinagaram ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
119	Sholavandan ...	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—
120	Usilampatti ...	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—
121	Andipati ...	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
122	Kombai ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
123	Batlagundu ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
124	Melur ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
125	Natham ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	Negative								Positive							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
126	Tiruparankundram ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
127	Ayakudi ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
128	Elumalai ...	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—
129	Nilakottai ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
130	Tiruchirapalli ...	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—
131	Karur ...	—	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—
132	Srirangam ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
133	Pudukottai ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
134	Golden Rock (R. C.)	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
135	Golden Rock (P. B.)...	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×
136	Thathayyangarpet ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
137	Turaiyur ...	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
138	Lalgudi ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
139	Thottiyam ...	—	—	—	—	—	—	×	—	—	—	—	×	—	—	—	—
140	Ariyalur ...	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—
141	Perambalur ...	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—
142	Palapatti ...	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—
143	Kulithalai ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
144	Udayarpalayam ...	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—
145	Marupatti ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
146	Musiri ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
147	Jayamgondachola-puram ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
148	Manachanallur ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
149	Manapparai ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
150	Varpattu ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
151	Ponnamaravathi ...	–	–	×	–	–	–	–	×	–	–	–	–	–	–	–	–
152	Aravankurichi ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
153	Punchaipugalur ...	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–
154	Kattuputhur ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
155	Poovalur ...	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–
156	Labbaikudikadu ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
157	Thanjavur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
158	Kumbakonam ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
159	Nagapattinam ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
160	Mayuram ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
161	Mannargudi ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
162	Tiruvarur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
163	Vedaranyam ...	–	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–
164	Sirkali ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–
165	Papanasam ...	–	–	–	–	–	–	×	×	–	–	–	–	–	–	–	–
166	Tranquebar ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–
167	Kuttalam ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
168	Tiruvidaimarudur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
169	Pattukottai ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
170	Adiramapattinam ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–
171	Ayyampettai ..	×	–	–	×	–		–	–	–	–	–	–	–	–	–	–
172	Tiruvaiyaru ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
173	Vallam ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
174	Thiruthuraipoondi ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
175	Muthupet ...	–	–	–	–	–	–	–	–	–	–	×	–	–	×	–	–
176	Tirukattupalli ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
177	Kuthanallur ...	–	–	–	–	–	–	–	–	–	–	×	–	–	×	–	–
178	Tirumullaivasal ...	–	–	–	–	–	–	–	–	×	–	–	×	–	–	–	–
179	Valangaiman ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
180	Arantangi ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
181	Nannilam ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
182	Kodavasal ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
183	Orathanad ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
184	Rajapalayam ...	–	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–
185	Srivilliputhur ...	–	–	–	–	×	–	–	–	–	×	–	–	–	–	–	–
186	Virudhunagar ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
187	Karaikudi ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–
188	Devakottai ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
189	Sivakasi ...	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–
190	Aruppukkottai ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
191	Ramanathapuram ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
192	Paramakudi ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
193	Ilayangudi ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
194	Sivaganga ...	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–
195	Tiruppathur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
196	Abiramam ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	Negative 10 + M	Negative 10 + F	Negative 5-10 M	Negative 5-10 F	Negative 2-5 M	Negative 2-5 F	Negative 0-2 M	Negative 0-2 F	Positive 0-2 M	Positive 0-2 F	Positive 2-5 M	Positive 2-5 F	Positive 5-10 M	Positive 5-10 F	Positive 10+ M	Positive 10+ F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
197	Kamudi ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
198	Watrap ...	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—
199	Seithur ...	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—
200	Rameswaram ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
201	Sattur ...	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—
202	Manamadurai ...	—	—	—	—	—	—	—	—	×	—	—	—	—	×	—	—
203	Tiruppuvanam ...	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—
204	Thondi ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
205	Kondanur ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
206	Pallathur ...	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—
207	Kilakarai ...	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—
208	Emaneswaram ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
209	Palayampatti ...	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—
210	Nattarasankottai ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
211	Kottaiyur ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
212	Mallinkinar ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
213	Singampunari ...	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—
214	Tuticorin ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
215	Tirunelveli ...	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—
216	Palayamkottai ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
217	Melapalayam ...	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—
218	Shencottah ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—
219	Tenkasi ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—
220	Kadayanallur ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5-10		2-5		0-2		0-2		2-5		5-10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
221	Puliangudi ...	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–
222	Kalladaikurichi ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
223	Viravanallur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
224	Cheranmadevi ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
225	Ambasamudram ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
226	Tiruchendur ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
227	Sivagiri ...	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–
228	Udangudi ...	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–
229	Vasudevanallur ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–
230	Surandai ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
231	Kulasekarapattinam.	–	–	–	–	–	–	–	×	–	–	×	–	–	–	–	–
232	Koilpatti ...	–	–	–	–	–	–	–	–	–	–	–	–	×	–	–	×
233	Srivaikuntam ...	–	–	–	–	–	–	–	–	×	×	–	–	–	–	–	–
234	Nanguneri ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
235	Sankarankoil ...	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–
236	Tachanallur ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
237	Ettayapuram ...	–	–	–	–	×	×	–	–	–	–	–	–	–	–	–	–
238	Kayalpatnam ...	–	–	–	–	–	–	–	–	×	–	–	–	–	×	–	–
239	Vikramasingapuram ...	–	–	–	–	–	–	–	–	×	–	–	×	–	–	–	–
240	Vadakkuvalliyur ...	–	–	–	–	–	–	–	–	×	–	–	–	–	×	–	–
241	Sathankulam ...	–	–	–	–	–	–	×	×	–	–	–	–	–	–	–	–
242	Pattamadai ...	–	–	–	–	–	–	–	–	–	–	×	×	–	–	–	–
243	Alwartnirunagari ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
244	Tisayanvillai ...	×	–	–	×	–	–	–	–	–	–	–	–	–	–	–	–

TABLE 2-20—(*Contd.*)

Classification of Migration-Cum-Statistical Error for Census Towns by Positive and Negative Error Groups, 1951-60—(*Contd.*)

Sl. No.	Census Town	NEGATIVE								POSITIVE							
		10 +		5–10		2–5		0–2		0–2		2–5		5–10		10+	
		M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
245	Kalugumalai ...	–	–	–	–	–	–	–	–	–	–	×	–	–	×	–	–
246	Kayathar ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
247	Eral ...	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–
248	Kadambur ...	×	×	–	–	–	–	–	–	–	–	–	–	–	–	–	–
249	Kalakad ...	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–
250	Panagudi ...	–	–	–	–	–	×	–	–	×	–	–	–	–	–	–	–
251	Sawyerpuram ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
252	Arumaneri ...	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–
253	Achamputhur ...	–	–	×	–	–	×	–	–	–	–	–	–	–	–	–	–
254	Sumboorvadakarai ...	–	–	×	–	–	–	–	–	–	–	–	×	–	–	–	–
255	Nagarkoil ...	–	–	–	–	–	–	–	–	–	–	–	–	×	×	–	–
256	Colachel ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
257	Kuzhithurai ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
258	Padmanabhapuram ...	–	–	×	×	–	–	–	–	–	–	–	–	–	–	–	–
259	Aramboli ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
260	Boothapandi ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
261	Kanyakumari ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
262	Eraniel ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
263	Kadiappattinam ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
264	Thiruvathamcode ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
265	Thuthoor ...																
266	Thengapattinam ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
267	Arumana ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×
268	Kollancode ...	–	–	–	–	–	–	–	–	–	–	–	–	–	–	×	×

TABLE 2-21.

Classification of Migration-Cum-Statistical Error for Total Population by Positive and Negative Error Groups for 1921-30, 1931-40, 1941-50

District	1921-30																1931-40							
	Negative								Positive								Negative							
	10+		5-10		2-5		0-2		0-2		2-5		5-10		10+		10+		5-10		2-5		0-2	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1. Madras ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—
2. Chingleput ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
3. North Arcot ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
4. South Arcot ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
5. Salem ...	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
6. Coimbatore ...	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	×	×
7. Nilgiris ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—
8. Madurai ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
9. Tiruchirapalli ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10. Thanjavur ...	—	—	—	—	×	—	—	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11. Ramanathapuram ...	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	×	×	—	—
12 Tirunelveli ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
13. Kanyakumari ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—
State ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×

Classification of Migration-Cum-Statistical Error for Total Population by Positive and Negative Error Groups for 1921-30, 1931-40, 1941-50—*contd.*

District	1931-40—*contd.*								1941-50															
	Positive								Negative								Positive							
	0-2		2-5		5-10		10+		10+		5-10		2-5		0-2		0-2		2-5		5-10		10+	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1. Madras ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
2. Chingleput ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—
3. North Arcot ...	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
4. South Arcot ...	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
5. Salem ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—
6. Coimbatore ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
7. Nilgiris ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
8. Madurai ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
9. Tiruchirapalli ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
10. Thanjavur ...	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
11. Ramanathapuram ...	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—
12. Tirunelveli ...	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
13. Kanyakumari ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
State ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—

TABLE 2-21-A

Classification of Migration-Cum-Statistical Error for Total, Rural, Urban Population by Positive and Negative Error Groups for 1951-60

District	Total																Rural							
	Negative								Positive								Negative							
	10+		5–10		2–6		0–2		0–2		2–5		5–10		10+		10+		5–10		2–5		0–2	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1. Madras ...	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—
2. Chingleput ...	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	×
3. North Arcot ...	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
4. South Arcot ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
5. Salem ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
6. Coimbatore ...	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
7. Nilgiris ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—
8. Madurai ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—
9. Tiruchirapalli ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
10. Thanjavur ...	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11. Ramanathapuram ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
12. Tirunelveli ...	—	—	×	—	—	×	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—
13. Kanyakumari ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	×	—	—	×	—	—	—	—
State ...	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×

Classification of Migration-Cum-Statistical Error for Total, Rural, Urban Population by Positive and Negative Error Groups for 1951-60—(*Contd.*)

District	Rural—*Contd.*								Urban															
	Positive								Negative								Positive							
	0-2		2-5		5-10		10+		10+		5-10		2-5		0-2		0-2		2-5		5-10		10+	
	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F
1. Madras ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—
2. Chingleput ...	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
3. North Arcot ...	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
4. South Arcot ...	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
5. Salem ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—
6. Coimbatore ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—
7 Nilgiris ...	—	—	—	—	—	—	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—
8. Madurai ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—
9. Tiruchirapalli ...	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—
10. Thanjavur ...	×	×	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
11. Ramanathapuram ...	—	—	—	—	×	×	—	—	×	×	—	—	—	—	—	—	—	—	—	—	—	—	—	—
12. Tirunelveli ...	—	—	—	—	—	—	—	—	—	—	—	—	×	—	—	×	—	—	—	—	—	—	—	—
13. Kanyakumari ...	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×
State ...	—	—	—	—	—	—	—	—	—	—	—	—	—	×	×	—	—	—	—	—	—	—	—	—

It is found that the migration-cum-statistical error for 1951–60 for rural as well as urban areas is —1.7% (of the 1961 population) and this is quite negligible. This clearly shows that our census and registration data are fairly accurate, but it is difficult to split this into its components, *viz.*, migration errors and registration errors. Migration-cum-statistical error has been worked out for 268 towns and it is found that a migration-cum-statistical error of over 100% (absolute) has been recorded in Poonamallee in Chingleput district and Thondi in Ramanathapuram district. There are variations by sex, but it is difficult to find reasons for the large variations observed in several towns. In Madras City, the migration-cum-statistical error is only 3.2% for males and 0.3% for females with a resultant 1.8% for persons of either sex. The migration-cum-statistical error has been classified for either sex positive or negative and further into 0–2, 2–5, 5–10 and 10 and above per cents. The district falling in each class is indicated in Table 2–21 and in Table 2–20 a similar classification has been attempted for the 268 towns. A synoptic view of this table is provided by the maps attached. The heavy positive error is found in rural areas of Nilgiris and Ramanathapuram districts in 1951–60 and this can be explained by heavy in-migration into these districts. The heavy negative error for rural Tirunelveli and Kanyakumari and positive error in urban Kanyakumari cannot be explained. But the negative error of 15% in urban Thanjavur is striking. An examination of the town-wise particulars seems to indicate that the error is high in all paddy procuring areas. This is perhaps due to an inflation of the 1951 census figures as a result of the rationing which might perhaps have induced a tendency to report more persons in each family to minimise procurement of paddy.

A test based on the Sample Census of 1951–52

As mentioned earlier, the Sample Census of Births and Deaths conducted in 1951 investigated whether the observed births and deaths were registered. If, however, the information relating to the registration of a particular event could not be obtained the word 'unknown' was noted against the question "whether the event was registered ?" No attempt was made to verify whether the householder's statement was correct and consequently a proportion of those reported as registered should actually fall in the category unregistered. However, assuming that those stated as registered and not registered were really so, it is possible to work out the "true" birth and death rates on the basis of alternative assumptions regarding those reported as 'unknown'.

The proportion of registered births among the unknown is not known but it is likely that the proportion of registered events among the unknown is considerably lower than among the verified ones. The proportion of unregistered events computed on the basis of the verified events will only lead to an exaggeration of registration efficiency whereas if the unknowns are treated as unregistered there will be an under estimation of registration efficiency. Appropriate correction factors have been worked out on the basis of these assumptions and applied to the registered rates and the estimated rates are given in columns 10 and 11 of Table 2–22.

TABLE 2–22

Upper and Lower Limits of Birth and Death Rates based on Sample Census Data, 1951–52

Items	Total events recorded in sample census	Reported as: Registered		Unregistered		Unknown		Registered rate	Rates corrected for under registration: including unknowns	assuming unknowns as not registered
		No.	%	No.	%	No.	%			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Births—										
Rural ...	978	717	73.3	93	9.5	168	17.2	26.04	29.41	35.53
Urban ...	655	507	77.4	42	6.4	106	16.2	37.91	41.04	48.98
Total ...	1,633	1,224	74.9	135	8.3	274	16.8	28.76	31.95	38.40
Deaths—										
Rural ...	654	480	73.4	100	15.3	74	11.3	14.78	17.86	20.14
Urban ...	481	381	79.2	40	8.3	60	12.5	21.10	23.31	26.64
Total ...	1,135	861	75.9	140	12.3	134	11.8	16.26	18.90	21.42

It is seen that the rural birth rate ranges from 29.4 to 35.5 whereas urban rate ranges from 41.0 to 49.0. In the case of deaths, the rural rate falls in the range 17.9 to 20.1 whereas the urban rate has a lower limit of 23.3 and an upper limit of 26.6. The latter is clearly untenable and this is probably due to the inclusion of several registered events in the 'unknown' category. In urban areas the births and deaths that occur in hospitals get registered even without any effort on the part of the householders and an error of this nature is possible. On the other hand in rural areas, with relatively little hospital facility, the opposite is likely to be the case. The sample census suffers from the limitation that no effort was made to check whether the events reported as registered were actually registered with the result that registered values got inflated. This limitation will be obvious when we see that the upper limit (21.4) of the death rate is actually less than the death rate of 22.8 for Madras State estimated by Mr. S. P. Jain for the 1941–51 decade.

Vital rates for the Poonamallee Health Unit

Another important evidence concerning vital rates can be had from the Poonamallee Health Unit. The Poonamallee Health Unit was started in 1934 with a view to establishing an intensive and well-knit public health organisation in the rural areas. The unit comprises of 39 revenue villages with a population of 63,000 and extends over 39 square miles. As a part of the scheme for upgrading the Hygiene Department in the Madras Medical College into the Department of Preventive and Social Medicine, a rural health centre was established in the Health Unit for affording practical training to students in public health work. Adequate staff were provided and the Government of India are bearing 50% of the expenditure on the establishment and maintenance of the unit. Further to demonstrate how the registration of births and deaths in a local area could be improved, a special Health Inspector for vital statistics work has been appointed in the Health Unit. The Director of Public Health, Madras, has pointed out that the registration of births and deaths is considerably better in the health unit than in the other rural areas of the State, largely because of the concentrated attention bestowed on the limited area. Moreover the registration work by the revenue staff in the area is actively helped by the activities of the health staff who during their periodical visits detect unregistered events and bring them into the records. It is therefore felt that greater reliance can be placed on the vital registration data of the Health Unit and the data could be made use of for obtaining a picture of the under registration in rural areas of the State.

The vital statistics of the health unit for 1951 to 1960 are given in Table 2–23.

TABLE 2–23

Vital Statistics of the Poonamallee Health Unit, 1951-60

Year		Births		Deaths	
		No.	Rate	No.	Rate
1951	...	1,955	32.6	1,452	24.2
1952	...	2,075	33.7	1,303	22.2
1953	...	1,763	28.7	1,303	21.2
1954	...	2,369	38.5	1,103	17.9
1955	...	2,857	46.4	1,237	20.1
1956	...	2,762	44.8	1,114	18.1
1957	...	2,979	46.9	1,425	22.5
1958	...	2,947	46.9	1,375	20.6
1959	...	2,928	46.6	1,282	19.1
1960	...	2,801	41.6	1,199	17.8
Average 1951-60	...	2,544	40.7	1,279	20.4

That the rates will be considerably less but for the detection of a large number of unregistered events will be evident from the following table.

TABLE 2–24

Unregistered events detected in the Health Unit areas, 1951-60

Year		Unregistered events detected		Percentage to total events	
		Births	Deaths	Births	Deaths
1951	...	209	108	10.7	7.4
1952	...	163	82	7.9	6.3
1953	...	60	64	3.4	4.9
1954	...	105	70	4.4	6.3
1955	...	72	49	2.5	4.0
1956	...	710	...	...	...
1957	...	902	...	...	...
1958	...	114	161	3.9	11.7
1959	...	123	169	4.2	13.2
1960	...	109	157	3.9	13.1

It is known that the registration in the Health Unit area bears a high order of accuracy. Further the Health Unit attracts people from neighbouring villages who come to the unit for availing the medical facility available there. Therefore, the vital rates of the Health Unit are likely to be on the high side. The impact of hospital facility is likely to be greater on the birth rate than on the death rate. Further Table 2–24 clearly shows that the percentage of cases detected is higher in the case of deaths than in the case of births. Assuming that the efficiency of detection work is the same for both births as well as deaths, a larger percentage of detection of unregistered deaths is due to a larger percentage of omission in the case of deaths than in the case of births. This is contrary to the common belief that the percentage under registration is higher in the case of births than that of deaths. By and large we may conclude that the average birth and death rate for 1951–60 for the Health unit, *viz.*, 40.7 and 20.4 may be regarded as the upper limits of the Birth and Death Rates of the rural areas of the State.

Comparative levels of birth and death rates in Madras and India

The data regarding birth and death rates available from these studies are summarised in Table 2–25.

TABLE 2–25

Birth and Death Rates as revealed by different surveys

	Madras	India
National Sample Survey :		
Birth rate	34.6	38.3
Death rate	14.0	19.0
Infant death rate	91.0	113.0
Census actuary 1941–50 :		
Birth rate	35.7	39.9
Death rate	22.8	27.4
Registration data 1959 (*after weeding*)*		
Birth rate	32.8	34.6
Death rate	14.1	14.2
Infant death rate	99.0	98.0
Vital statistics of Towns with population 30,000 *and over* †		
Birth rate	43.8	34.6
Death rate	17.2	12.9
Infant death rate	98.0	87.0

* All India figures are based on the data for Punjab, Mysore, Madras and Bombay.

† All India figures are based on Andhra Pradesh, Bombay, Kerala, Madras, Mysore, Orissa and Punjab.

These figures do not clearly show any consistent pattern of birth, death and infant death rates in Madras State and India. They may perhaps indicate that Madras had a lower level of fertility and mortality when compared to India during the 1941–51 decade, which situation is likely to continue even to the present day. If the National Sample Survey results could be taken as indicative of a fairly correct picture of the vital rates, Madras State should be having a birth rate of around 35 as against the All-India rate of around 39; the corresponding death rate will be 14 for Madras State and 19 for India.

The following table gives the registered birth and death rates for Municipal Towns, Census Towns, and Rural areas for the years 1950 to 1959.

TABLE 2–26

Birth and Death Rates for Municipal Towns, Census Towns and Rural Areas

Year	Birth Rate			Death Rate		
	Municipal towns	Census towns	Rural areas	Municipal towns	Census towns	Rural areas
1950 ...	44.9	27.0	29.3	27.9	16.3	18.8
1951 ...	38.1	22.3	26.5	22.5	13.0	15.6
1952 ...	40.0	25.0	28.3	21.2	12.9	15.1
1953 ...	36.7	21.6	25.0	22.5	12.1	19.8
1954 ...	28.0	22.4	24.7	18.3	10.4	12.8
1955 ...	41.0	24.5	30.0	17.5	10.0	13.8
1956 ...	39.4	22.8	25.7	16.9	9.5	13.3
1957 ...	39.7	22.2	24.2	18.3	10.3	13.7
1958 ...	39.8	22.8	24.4	16.9	9.4	12.6
1959 ...	40.5	25.9	25.9	15.5	8.9	11.4
Average ...	39.8	23.7	26.4	19.8	11.3	14.7

It is seen from this statement that the birth and death rates in Municipal Towns are in excess of those in Census Towns which are again higher than those in rural areas.

The Director of Public Health was asked to offer his remarks regarding the rural-urban differentials in birth and death rates and he has stated that " the registration

is probably more complete in municipal areas than in rural areas, but it is not known whether registration in census town areas is more complete than in rural areas. A separate birth and death registrar (qualified Sanitary Inspector) is appointed in Municipal areas, whereas in rural and census town areas excepting a few census towns, the registration is being done by village Munsiffs who have to perform many other important revenue and other duties. Registration in municipal areas is therefore likely to be better than in rural areas. As the census towns are large in extent and population, it is quite likely that the registration done by Munsiffs in census towns is more defective than that by the village Munsiffs for compact villages with a small population. It is, therefore, probable that the registration of births and deaths in rural areas is a little better than in the census town areas."

The Director of Public Health was specifically requested to comment whether the higher birth and death rates in municipal areas could be due to the large influx of people to these areas to utilise the hospital and maternity facilities in these areas and the births and deaths occurring to such persons usually get registered in the municipal areas. The Director of Public Health agrees with this view, but has stressed "it is difficult to find from the registers whether a birth or death relates to a resident population, as the entries therein do not show straightaway that the party is a local resident or not. Enquiries have therefore to be instituted to find out whether an event related to resident or non-resident population. In this connection, it is also necessary to define who is a resident of a place. It is quite likely that a few residents in municipal areas might have gone to other municipal areas or non-municipal areas and as such credit should be given to the resident births or deaths occurring outside municipal areas. Such data are not available. In the absence of such data it may be presumed that the magnitude of the error is small."

Hospital data study for residential classification

An attempt has, therefore, been made to fill the gap in the data mentioned above and a study of the hospital births and deaths in the Madras City during 1958, 1959 and 1960 and all municipal areas during 1960 was instituted by us to classify the births and deaths according to three major categories :

(i) Those relating to same municipality.

(ii) Those relating to other municipalities in the State.

(iii) Those relating to census towns and rural areas.

Still-births were excluded from the purview of this study and residents of other States when negligible were omitted.

"Residents" were defined as those who have reported themselves as residing in any of the streets or wards within the limits of the municipality. In the registers of hospital births and deaths maintained by Madras Corporation, the residential address of the registered person is entered and with the help of a city map there was no difficulty in classifying them according to the three categories mentioned above. In the case of the remaining 64 Municipalities in the State, the Municipal Commissioners/Executive Health Officers of the municipalities were addressed to furnish such particulars. Out of these 64 municipalities, only 43 municipalities have furnished the information. These results have been tabulated and presented in Table 2-27.

TABLE 2-27

Results of the Study on Hospital Births and Deaths in Madras City and Municipal areas

(Percentages to total)

	Year	Births: Same Municipality	Births: Other Municipality	Births: Census towns and rural areas	Deaths: Same Municipality	Deaths: Other Municipality	Deaths: Census towns and rural areas
Madras ...	1958	93.6	1.1	5.3	84.9	1.1	14.0
	1959	93.4	0.9	5.7	80.1	2.0	17.9
	1960	91.8	0.9	7.3	80.7	0.8	18.5
	Average	92.9	1.0	6.1	81.9	1.3	16.8
43 Municipalities ...	1960	63.6	1.8	34.6	50.6	4.1	45.3

The following conclusions are drawn from the above statement :

(i) About 6% of the births and 17% of deaths occurring in Madras City relate to "non-residents" belonging to rural areas and census towns whereas these percentages are as high as 35% for births and 45% for deaths in the case of the 43 municipalities covered by the study.

(ii) The percentage of births and deaths of those from other municipalities is negligible in either case. In Madras City about 1% of births and deaths relate to persons from other municipalities, whereas in the case of the 43 municipalities, the percentages are 2% for births and 4% for deaths respectively.

(iii) Another striking point is that the "Pull" of the cities and Municipalities is greater in the case of deaths than in the case of births, as evident from the larger percentage of non-residents among deaths than among births. A similar result has been obtained in respect of Nagpur City (vide page V of Introductory Note to the Vital Statistics of India for 1959) where about 9% of births and 33% of deaths relate to non-residents.

(iv) While no definite conclusions can be drawn regarding trends based on the data for only three years, it is striking that the "Pull" of the city to the residents of rural areas and census towns by its medical facilities is on the ascendency as evident from the following percentages :

		Births	*Deaths*
1958	...	5.3	14.0
1959	...	5.7	17.9
1960	...	7.3	18.5

(v) The larger percentage of "Non-resident" births and deaths in the municipalities when compared to Madras City may be due to the fact that the medical and hospital facilities available in the City have reached their limits of overcrowding which deter many non-residents from coming to the City Hospitals and clinics and perhaps the 6% of births and 17% of deaths in the City Hospitals relate to those non-residents who have gained admission in these hospitals in spite of such hardships.

Estimates of municipal rates

The above results are used for finding the "true" birth and death rates in the Municipalities. For arriving at the true rates the following formula is employed.

$$R_t = R_o \times p$$

where R_t and R_o are the true and observed rates and p is the proportion of resident events.

Applying the value ot p, R_o and R_t based on the above study are as tollows :

Event		R_o	'p'	R_t
Birth	...	39.8	.636	25.3
Death	...	19.8	.506	10.0

This method is based on the assumption that the proportion of "non-resident" events among hospital births and deaths will be the same as the proportion in respect of all cases. Even if this assumption is not true, alternatively the number of births and deaths relating to these areas will be the observed number of births and deaths less the births and deaths known to be those of non-residents. In other words, this provides an alternative method of obtaining more refined birth rates and death rates for these areas. Symbolically, an alternative vital rate R_t will be given by the formula.

$$R_t = R_o - R_u$$

where R_u will be the non-resident events per 1,000 of the mid year population. This is illustrated with the help of the following figures :—

(1) Population of the 43 municipalities in 1951	...	P_{51}	= 2,425,488
(2) Population of the 43 municipalities in 1961	...	P_{61}	= 2,881,063
(3) Arithmetic mean decennial population	...	$\frac{P_{51} + P_{61}}{2}$	= 2,653,276
(4) Average annual births during 1951–60	...	B	= 109,656
(5) Average annual deaths during 1951–60	...	D	= 47,004

(6) Mean decennial birth rate ...	=	41.3
(7) Mean decennial death rate ...	=	17.7

Now, out of the 109,656 births and 47,004 deaths registered in these 43 municipalities annually, 28,355 births and 5,478 deaths relate to non-residents and hence these events should be excluded from the vital rates of these municipalities. The rates corresponding to non-resident births and deaths work out to 10.7 and 2.1 respectively. Hence an alternative set of birth and death rates obtained thus are 30.6 and 15.6 respectively. Using the earlier method for estimating birth and death rates for the 43 municipalities we get a birth rate of 26.3 and a death rate of 9.0.

In other words these two procedures give rise to the upper and lower limits to the birth and death rates of municipalities, provided the registration is 100% efficient. But in practice there is some under-registration of births and deaths in municipalities also. If we assume that this under-registration will be of the order of 10% these upper and lower limits may be raised to this extent. The upper and lower limits of municipal rates thus obtained are summarised below:

		Upper limit	*Lower limit*
Birth rate	...	33.7	28.9
Death rate	...	17.2	9.9

From the above, it is however difficult to reach any conclusion regarding the exact level of the birth and death rates in municipalities, but it is likely that the true rates are near the upper limits.

We may now compare these figures with those of the census towns and rural areas :

		Birth Rate	*Death Rate*
Census towns	...	23.7	11.3
Rural areas	...	26.4	14.7
Municipal Estimates :			
Upper limit	...	33.7	17.2
Lower limit	...	28.9	9.9

The observed rates of census towns and rural areas are lower than those of the municipalities. It is common knowledge that these rates suffer from serious under-registration, and it will be the object of demographic analysis to find whether all the observed difference could be explained by this factor alone. In other words the question still remains whether there are any real rural-urban differentials in the vital rates.

The Differencing method for estimating death rates

The total count P^{61}_{10+} of persons enumerated at the 1961 census at ages 10 and above are the survivors of the entire population enumerated at the previous census P^{51}_{0+}. The difference $(P^{51}_{0+} - P^{61}_{10+})$ between the two will therefore represent all the deaths that occurred in the decade between the two censuses excluding the deaths of those born in that decade, plus surviving fresh out-migrants at ages 10 and above minus surviving fresh immigrants at ages 10 and above. Since the age distribution of the fresh immigrants and out-migrants are not available, one has to assume that the migratory population has the same age composition as the resident population.

Forgetting for the moment the effect of migration, the difference $P^{51}_{0+} - P^{61}_{10+}$ includes some of the deaths in (0–4) age group which occurred in the first 5 years of the decade and excludes certain deaths in the age group (5–9). If we assume that these are approximately equal, $P^{51}_{0+} - P^{61}_{10+}$ will represent the deaths at ages 5 and above that occurred during the decade. However, since mortality in the ages 0–4 is higher than the mortality in ages 5–9, a positive error is introduced. One refinement will be to inflate the estimated deaths in ages 5 and above by the ratio of the total registered deaths at ages 5 and above. The vital registration data of Madras State is fairly adequate for the above refinement. Here again, one faces the difficulty that the degree of under registration of deaths in ages 0–4 is greater than in the age group 5–9 and the refined estimate is likely to be an under estimate. Further, the registered deaths may include the deaths among immigrants and exclude the deaths among out-migrants. Here again one is forced to assume that the effect of migration on registered deaths is negligible.

Symbolically,

the natural population at the 1951 census—N_{51}
$= P_{51} + E_{51} - I_{51}$

the natural population at the 1961 census—N_{61}
$= P_{61} + E_{61} - I_{61}$

Deaths at ages 5 and above $= d^1$

$$= P_{51} - f\,P_{61} + (E_{51} - I_{51}) - (E_{61} - I_{61})$$

$$= P_{51} - f\,P_{61} + (I_{61} - I_{51}) - (E_{61} - E_{51})$$

where P, E and I denote the total population, number of out-migrants and immigrants of the State recorded

in the specified census and f is the proportion of persons aged 10 and above to the total population. At the time of making this calculation data regarding $(I_{61} - I_{51})$ and $(E_{61} - E_{51})$ are not available. Assuming that these roughly cancel each other,

$d^1 = P_{51} - f\,P_{61}$. The total number of deaths d is then estimated from

$$d = d^1 \frac{D}{D^1}$$

where D and D^1 denote the registered deaths of all ages and those for ages 5 and above respectively. Using the registration data for 1957, $\frac{D}{D^1}$ was found to be 1.6666.

Now, the total deaths d may be divided by the mean natural population of the decade (i.e.) $\frac{N_{51} - N_{61}}{2}$ to obtain the mean death rate, but once again in the absence of data on number of persons born elsewhere and enumerated in the State and *vice versa*, we may assume that :

$$\frac{N_{51} - N_{61}}{2} = \frac{P_{51} - P_{61}}{2}$$

The death rate for 1951—61 by this procedure comes to 27.9 for the State which is considerably higher than the registered death rate of 14 for 1956–57. The registered deaths at ages 5 and over during 1957 are 276,610 whereas the difference between 1951 population and 1961 population aged 10 + is 5,349,147. The difference appeared to be very high and this could be due to :

(*a*) comparatively more complete enumeration in 1951 census ;

(*b*) a substantial fresh net out-migration in the place of a fresh net immigration in the previous decade ;

(*c*) a possible spurious inflation of the 1951 figures due to then prevailing circumstances which are largely absent in 1961.

As regards (a) while it is difficult to say how far this factor has been operative it may be stated that a fall of ½ per cent in efficiency would make a difference of nearly 1.6 lakhs. This would no doubt reduce the difference, but there would still be something left over to be explained on the basis of (b). This has been examined separately. Regarding (c), the possibilities of a spurious inflation of the 1951 census count could not be ruled out in view of the food rationing prevalent then.

It is, however, difficult to assess objectively the relative role of the various factors which could be responsible for the very high value of the computed death rate. It may happen that each of these factors is operating to some extent. In the present case, the high value of the computed death rate is likely to be due to a reversal of the migration trends in 1951—61. For purposes of argument, the migration changes necessary to bring about different values of death rate have been worked out on the basis that "migration" is the weak spot in our study. These figures could help us in deciding the death rate to be adopted. It is highly unlikely that the death rate can be greater than 20 per mille. For this rate, the migration change should be a net out-migration of the order of 9.6 lakhs if we assume a birth rate of 35 per mille. If the death rate is 18 and the birth rate is 35, then the net out-migration should be of the order 1.6 millions. At the moment it appears useless to apply the differencing method to get the estimates of death rate separately for rural and urban areas, since in addition to the factor of inter-State migration, the forces of rural-urban movement could upset our calculations. Presented below are the hypothetical Balancing Equations for different values of birth rate, death rate, migration rate and growth rate (per 1,000 of mid decennial population).

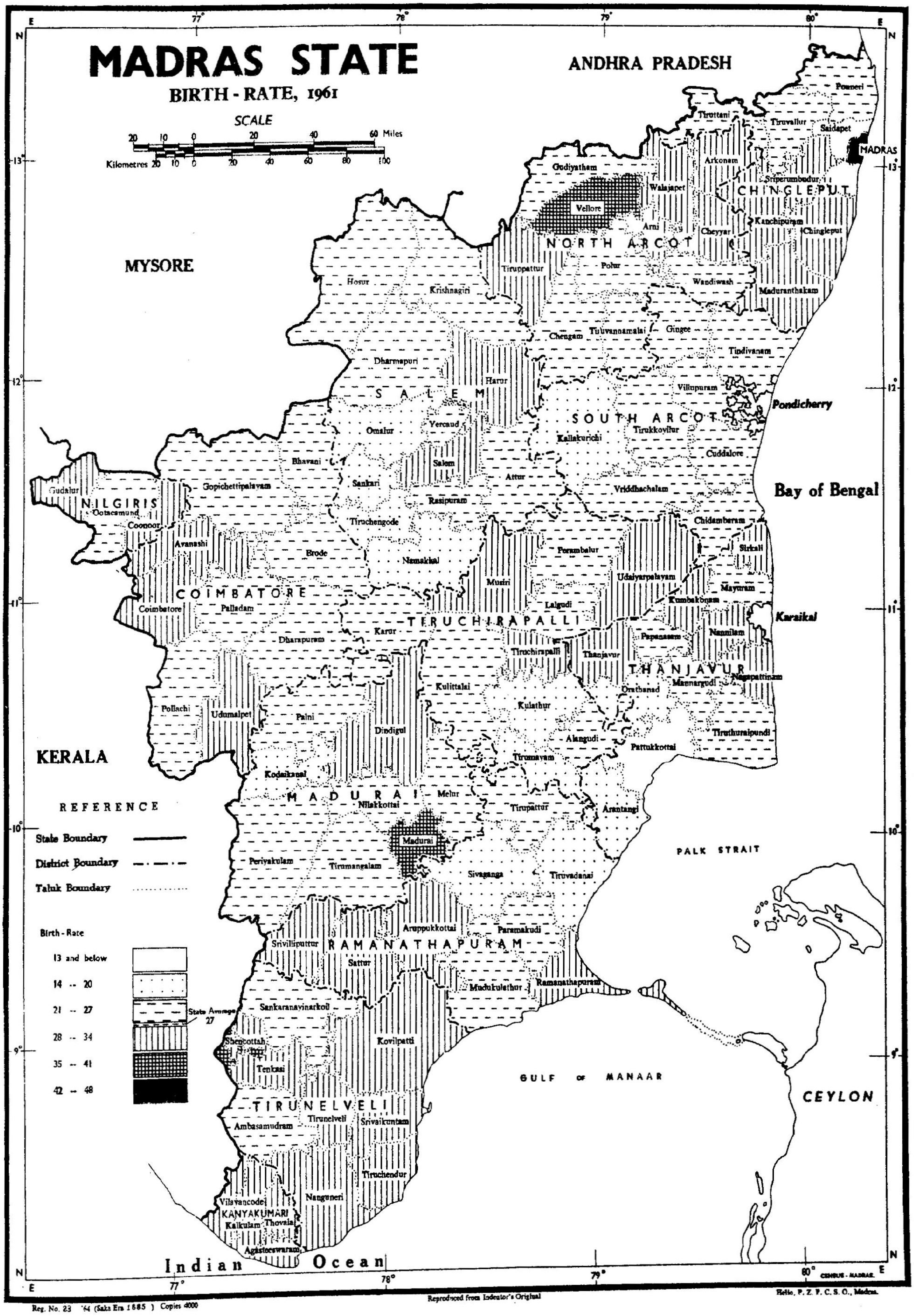
TABLE 2–28

Hypothetical Balancing Equations for different values

Growth Rate	Birth Rate	Death Rate	Migration Rate
12	35	20	—3
12	34	20	—2
12	33	20	—1
12	33	19	—2
12	33	18	—3
12	33	17	—4

Estimated Birth and Death Rates for 1921—30 to 1951—60

As a part of the present study, an estimate of the birth and death rates was attempted for the present Madras State. The basic data for the study is the census age data for 1921, 1931, 1941, 1951 and 1961 adjusted for boundary changes. The birth rate has



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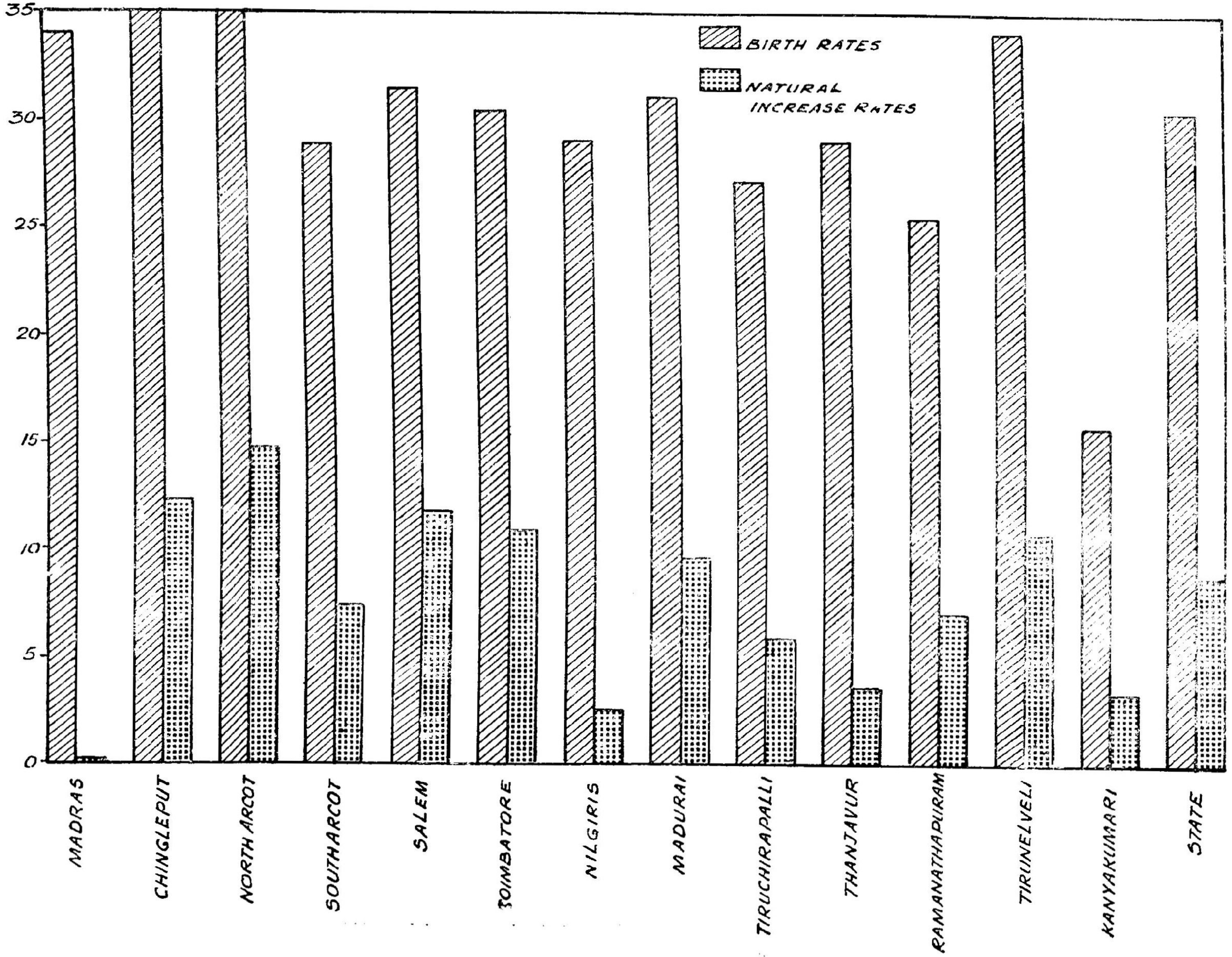
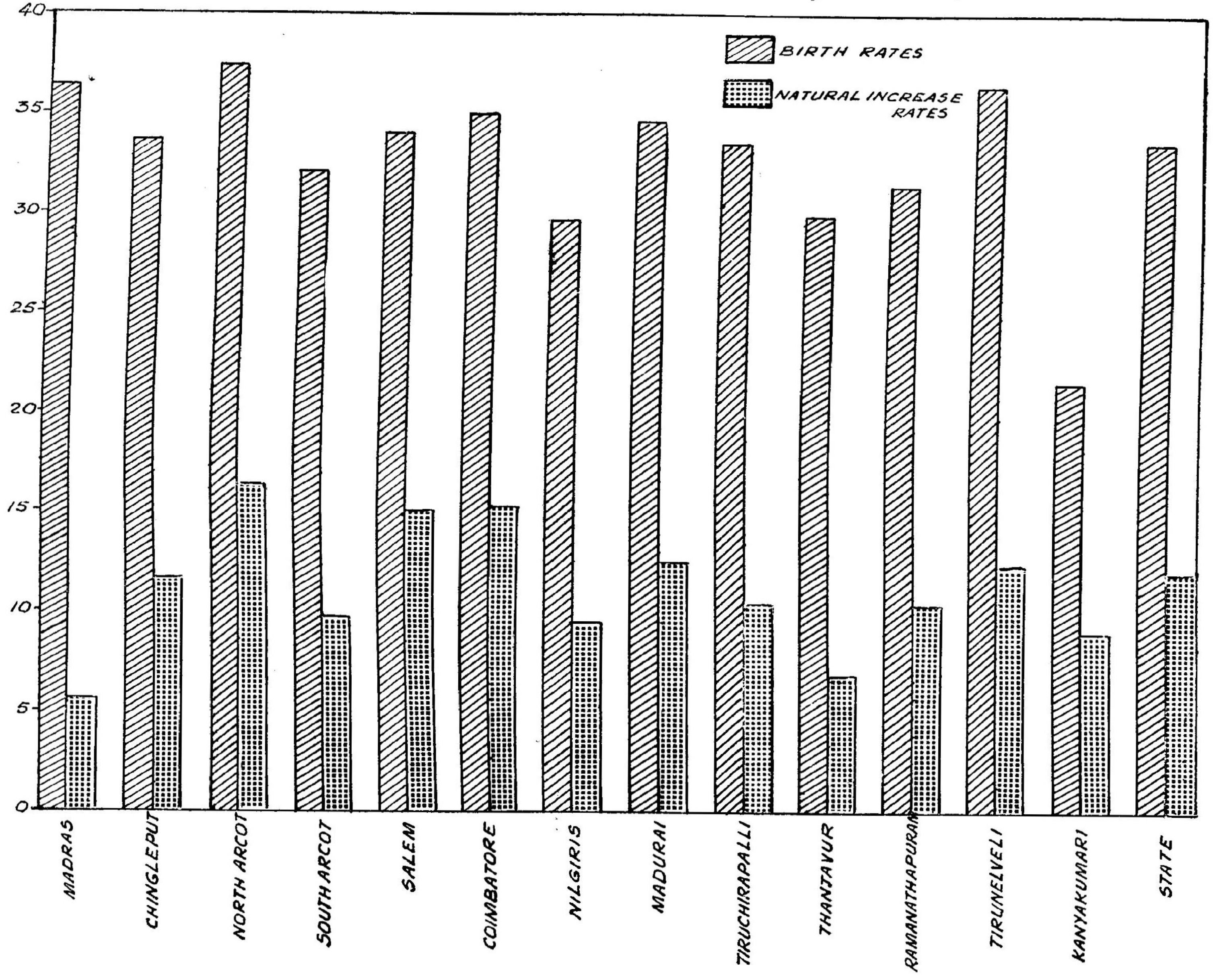
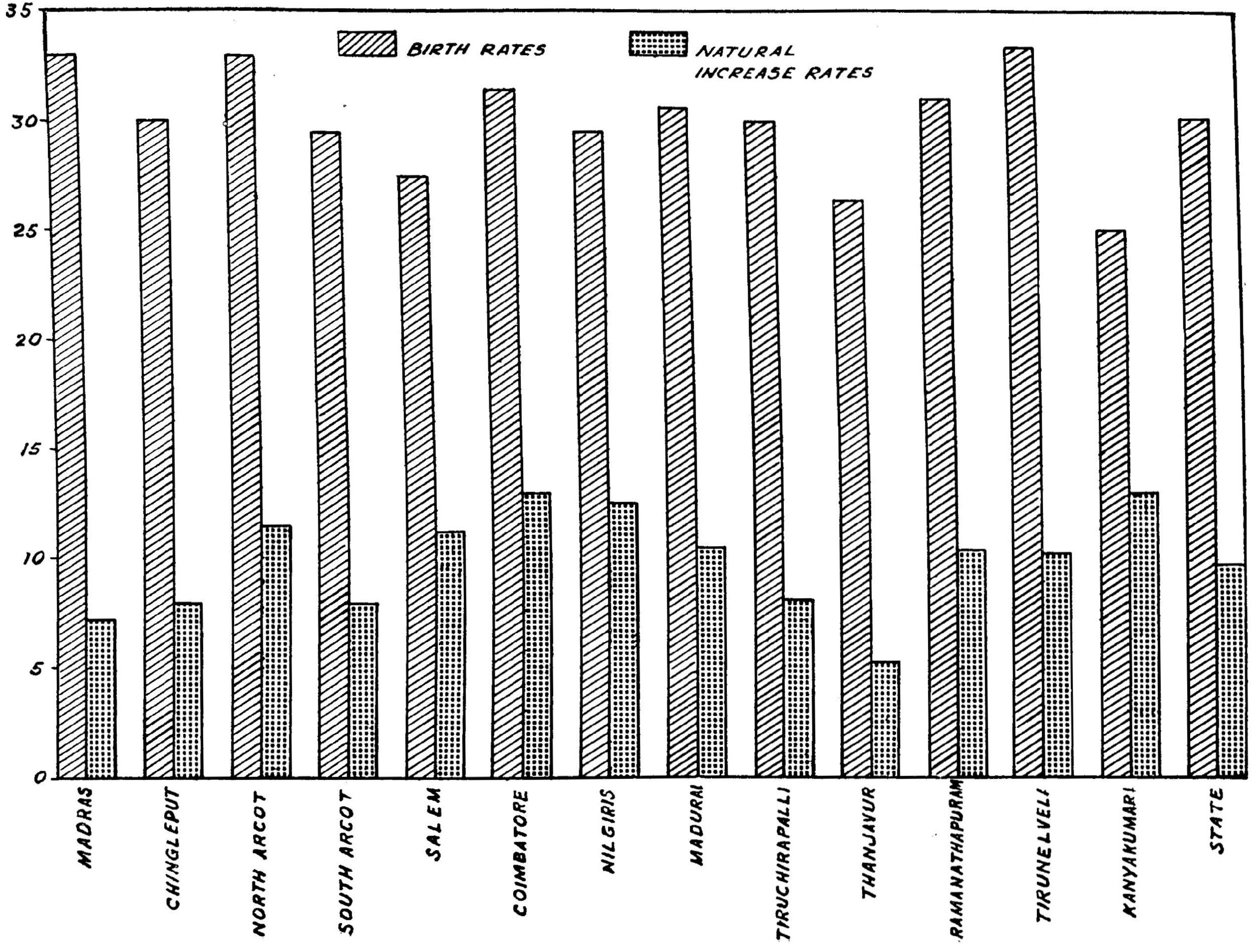
BIRTH AND NATURAL INCREASE RATES, 1921-1930



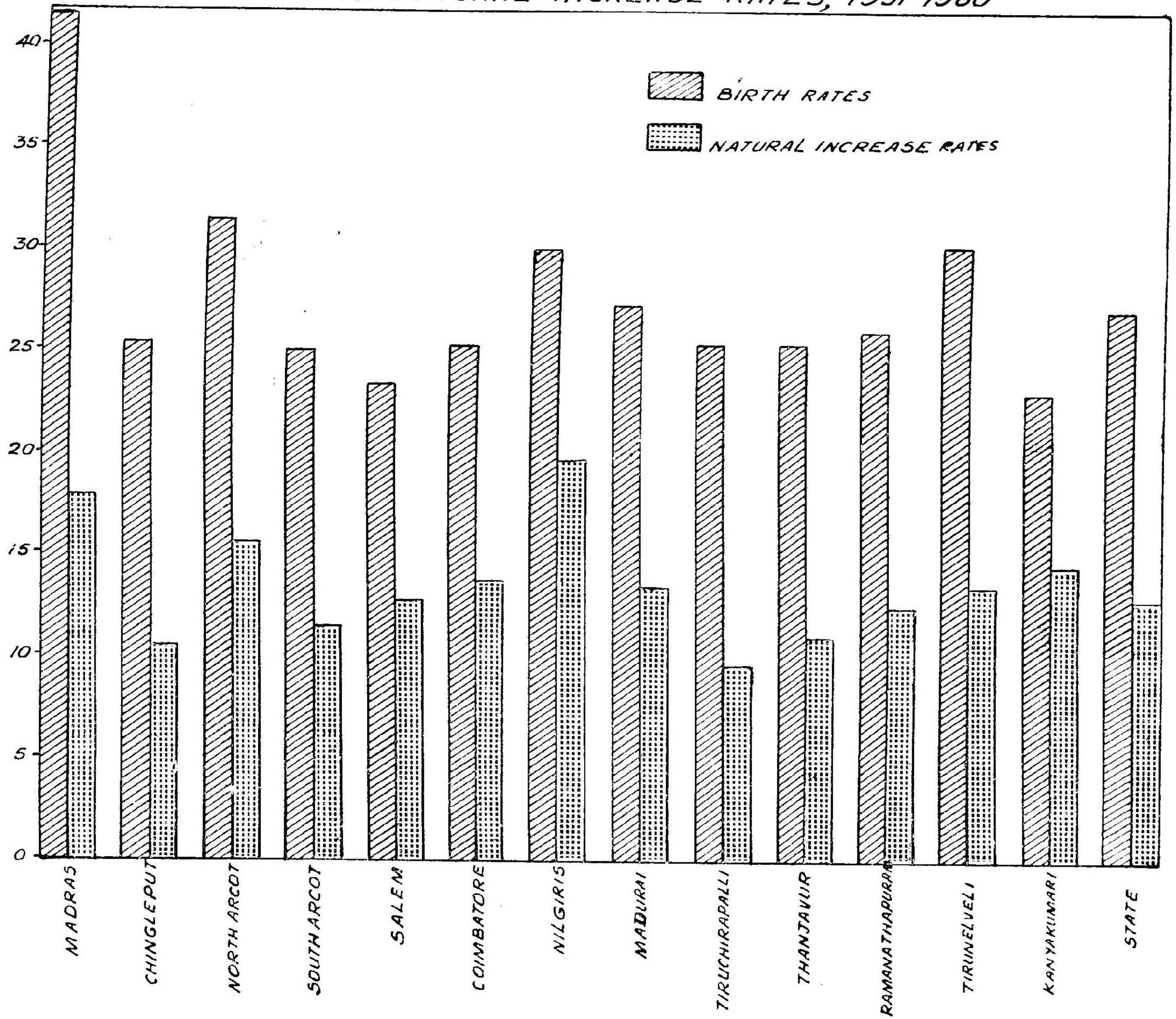
BIRTH AND NATURAL INCREASE RATES, 1931 - 1940



BIRTH AND NATURAL INCREASE RATES, 1941-1950



BIRTH AND NATURAL INCREASE RATES, 1951-1960



been derived by following the age group 5-9 which is known to be better reported in the Indian Censuses. The detailed methodology adopted is described in Appendix XV. The death rate has been deduced from the birth rate as a residual from the growth rate assuming the effect of migration to be negligible. The figures are set out below.

TABLE 2-29

Estimated Birth and Death Rates for Madras State, 1921—30 to 1951—60

Period		Growth Rate	Birth Rate	Death Rate
1921-30	...	8.6	42.8	34.2
1931-40	...	11.4	41.1	29.7
1941-50	...	15.4	35.8	20.4
1951-60	...	11.2	34.9	23.7

It is seen that there has been little change in the birth rate and what is more striking, the birth rate of 34.9 obtained by this method coincides with the estimate of Mr. Jain. Almost all the discussions in the earlier sections seem to indicate a birth rate of around 35. However the death rate in the column has shown an increase during the last decade. This can be due to a large scale out-migration which has been left out of the picture. In the 1951-61 decade it appears reasonable to assume an out-migration of 4 per cent in the decade or 4 per thousand per annum. If this is assumed the death rate for 1951—60 after accounting for migration will be 19.7 per mille. This appears to be a small decline in the death rate when compared to the rate of 22.4 for the earlier decade, after accounting for a net in-migration of 2% in that decade. A large decline of the magnitude of the earlier decade has not probably happened during the last decade as after a stage, further decline in death rate is harder to attain. The decennial death rate for the 1951—60 decade should therefore be of the order of 20 per 1,000, perhaps somewhat less and the birth rate may be of the order of 35 per 1,000 leaving natural increase rate of 14 per thousand.

Good and Bad Registration areas

We have presented in Tables 2-30 and 2-31 the taluks of the State classified in suitable ranges of birth and death rates and a synoptic view can be had from the maps attached.

Once we fix the probable level of the birth and death rates for the decade 1951—60 it is possible to determine what are the good registration areas and what are the bad registration areas. The classification has to be rather arbitrary, as there are possible year to year variations in fertility as well as mortality, and still more important, there may be real differences between one area and another in the birth and death rates. Taking the clue from Sri Asok Mitra's Report for 1951 for West Bengal, we have broadly classified the birth and death registration areas on the following criteria.

TABLE 2-30

Registered Birth Rate by Taluks arranged in different Ranges, 1961

	Ist Range : Below 14	
Chingleput ...	... Saidapet	11
Thanjavur ...	... Pattukkottai	13
	IInd Range : 14 *to* 20	
South Arcot ...	... Kallakurichi	17
Salem ...	... Omalur	17
	Sankari	20
	Tiruchengode	18
	Namakkal	20
Madurai ...	... Kodaikanal	19
Tiruchirapalli ...	... Kulathur	15
	Tirumayam	16
Thanjavur ...	... Orthanad	16
	Arantangi	14
Ramanathapuram	... Sivaganga	15
	Tiruvadanai	17
	IIIrd Range : 21 *to* 27	
Chingleput ...	... Ponneri	21
	Tiruvallur	26
	Tiruttani	23
North Arcot ...	... Gudiyatham	27
	Wandiwash	25
	Polur	27
	Chengam	25
	Tiruvannamalai	25
South Arcot ...	... Gingee	23
	Tindivanam	25
	Villupuram	22
	Tirukkoyilur	23
	Vriddhachalam	22
	Cuddalore	25
	Chidambaram	24

TABLE 2-30—(*Contd.*)

Salem ...	... Hosur	22
	Krishnagiri	24
	Dharmapuri	23
	Yercaud	22
	Rasipuram	26
	Attur	22
Coimbatore ...	... Bhavani	25
	Gobichettipalayam	27
	Erode	23
	Dharapuram	23
	Palladam	23
	Pollachi	23
Nilgiris ...	... Ootacamund	26
Madurai ...	... Palani	26
	Periyakulam	26
	Nilakottai	27
	Melur	24
	Tirumangalam	26
Tiruchirapalli ...	... Perambalur	27
	Lalgudi	23
	Karur	21
	Kulithalai	26
	Alangudi	25
Thanjavur ...	... Mayuram	26
	Papanasam	22
	Mannargudi	25
	Tiruthuraipundi	25
Ramanathapuram	... Tiruppathur	22
	Paramakudi	23
	Mudukulathur	26
Tirunelveli ...	... Sankaranayanarkoil	24
	Ambasamudram	25

ABOVE THE STATE AVERAGE

IVth Range : 28 *to* 34

Chingleput ...	... Sriperumbudur	31
	Chingleput	34
	Kancheepuram	33
	Madurantakam	30
North Arcot ...	... Arkonam	28
	Walajapet	31
	Tiruppattur	34
	Arni	32
	Cheyyar	31
Salem ...	... Harur	28
	Salem	31
Coimbatore ...	... Avanashi	28
	Coimbatore	28
	Udumalpet	28
Nilgiris ...	... Gudalur	31
	Coonoor	29
Madurai ...	... Dindigul	28
Tiruchirapalli ...	... Udaiyarpalayam	30
	Musiri	28
	Tiruchirapalli	28
Thanjavur ...	... Sirkali	30
	Kumbakonam	30
	Nannilam	28
	Thanjavur	28
	Nagapattinam	30
Ramanathapuram	... Ramanathapuram	29
	Aruppukkottai	34
	Sattur	28
	Srivilliputhur	28
Tirunelveli ...	... Kovilpatti	34
	Srivaikuntam	30
	Tirunelveli	31
	Tenkasi	32
	Nanguneri	29
	Tiruchendur	30
Kanyakumari ...	... Vilavancode	28
	Kalkulam	29
	Thovala	31
	Agastheeswaram	29

Vth Range : 35 *to* 41

North Arcot ...	... Vellore	40
Madurai ...	... Madurai	35
Tirunelveli ...	... Shencottah	38

VIth Range : 42 *to* 48

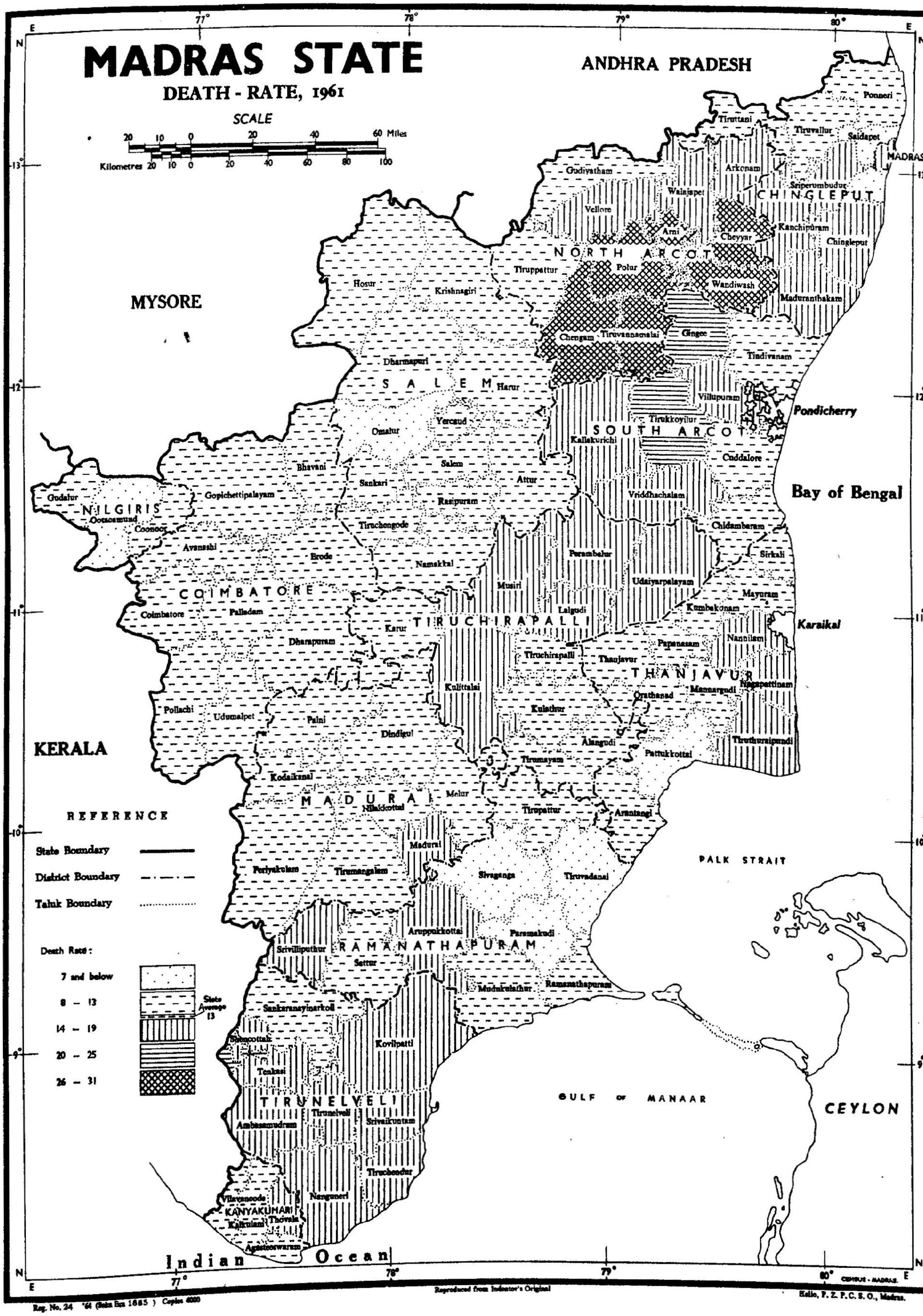
Madras District ...	... Madras City	42

TABLE 2-31

Registered Death Rate by Taluks arranged in different Ranges, 1961

Ist Range : 7 *and below*

Chingleput ...	... Saidapet	6
Salem ...	... Omalur	6
Nilgiris ...	... Ootacamund	7
Thanjavur ...	... Pattukkottai	7
Ramanathapuram ...	... Sivaganga	7
	Tiruvadanai	6
	Paramakudi	7



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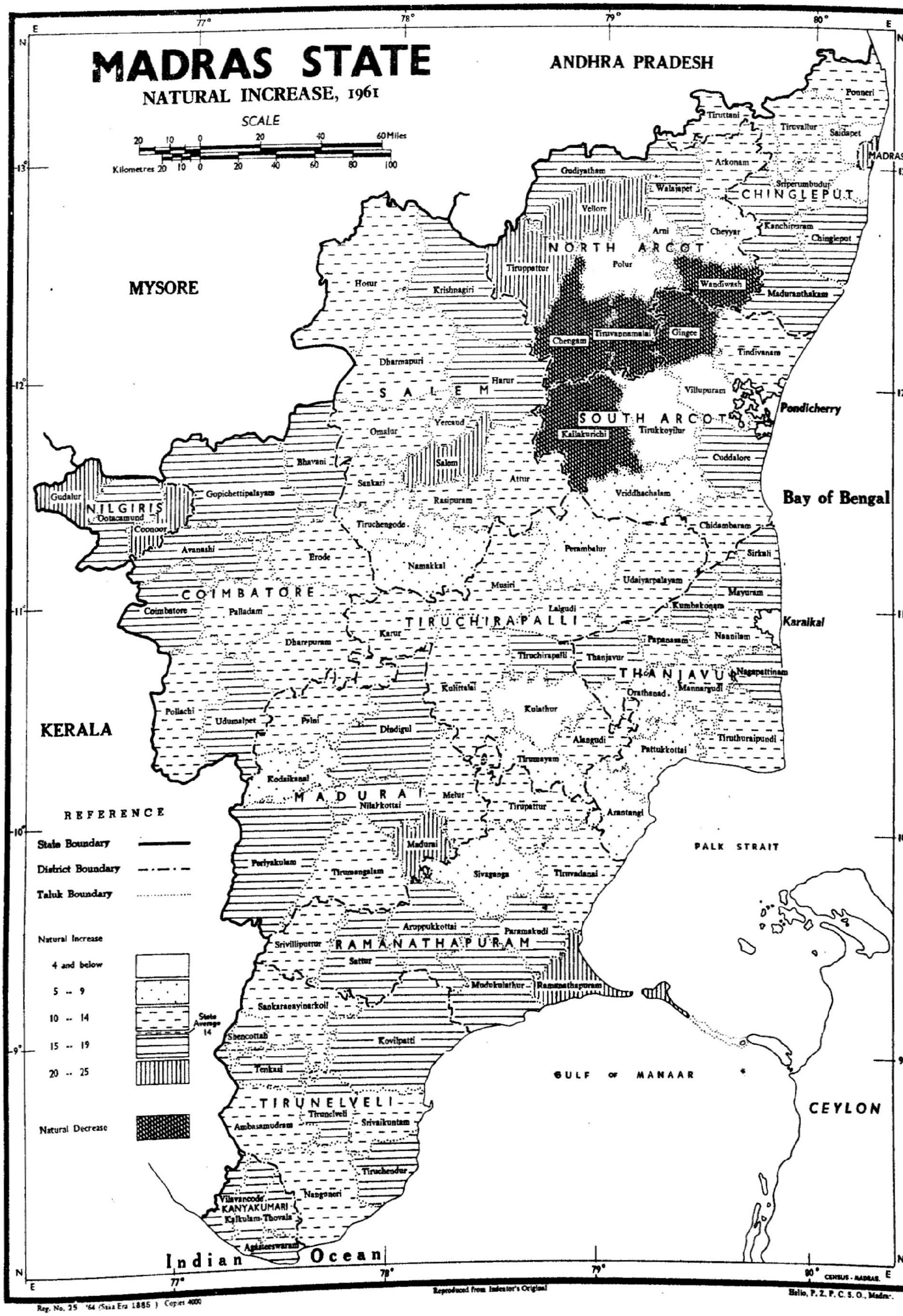

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TABLE 2-31—(*Contd.*)

IInd Range : 8 to 13

Chingleput ...	... Ponneri	10
	Tiruvallur	12
	Tiruttani	11
North Arcot ...	... Gudiyatham	12
	Tiruppathur	12
South Arcot ...	... Tindivanam	13
	Cuddalore	10
	Chidambaram	11
Salem ...	... Hosur	10
	Krishnagiri	8
	Harur	10
	Dharmapuri	9
	Yercaud	9
	Salem	12
	Sankari	8
	Tiruchengode	9
	Rasipuram	12
	Attur	10
	Namakkal	13
Coimbatore ...	... Bhavani	9
	Gobichettipalayam	11
	Erode	10
	Dharapuram	11
	Palladam	10
	Avanashi	12
	Coimbatore	10
	Pollachi	10
	Udumalpet	12
Nilgiris ...	... Gudalur	9
	Coonoor	8
Madurai ...	... Dindigul	13
	Palani	13
	Kodaikanal	12
	Periyakulam	9
	Nilakkottai	12
	Melur	10
	Tirumangalam	13
Tiruchirapalli ...	... Karur	12
	Tiruchirapalli	11
	Kulathur	12
	Alangudi	12
	Tirumayam	9
Thanjavur ...	... Sirkali	12
	Mayuram	12
	Kumbakonam	13
	Papanasam	12
	Thanjavur	13
	Orthanad	8
	Mannargudi	12
	Arantangi	8
Ramanathapuram	... Tiruppathur	9
	Ramanathapuram	8
	Mudukulathur	10
	Sathur	11
Tirunelveli ...	... Sankaranayinarkoil	13
Kanyakumari ...	... Vilavancode	9
	Kalkulam	11
	Agastheeswaram	10

ABOVE THE STATE AVERAGE

IIIrd Range : 14 to 19

Madras District ...	... Madras City	19
Chingleput ...	... Sriperumbudur	17
	Chingleput	15
	Kancheepuram	17
	Madurantakam	15
North Arcot ...	... Arkonam	15
	Walajapet	17
	Vellore	18
South Arcot ...	... Villupuram	18
	Kallakurichi	18
	Vriddhachalam	17
Madurai ...	... Madurai	14
Tiruchirapalli ...	... Perambalur	18
	Udaiyarpalayam	16
	Lalgudi	14
	Musiri	14
	Kulithalai	14
Thanjavur ...	... Nannilam	15
	Nagapattinam	15
	Tiruthuraipundi	14
Ramanathapuram	... Aruppukkottai	17
	Srivilliputtur	14
Tirunelveli ...	... Kovilpatti	18
	Srivaikuntam	15
	Tirunelveli	15
	Tenkasi	17
	Ambasamudram	16
	Nanguneri	14
	Tiruchendur	13
Kanyakumari ...	... Thovala	15

IVth Range : 20 to 25

South Arcot ...	... Gingee	23
	Tirukkoyilur	21
Tirunelveli ...	... Shencottah	22

TABLE 2-31—(*Contd.*)

Vth Range : 26 *to* 31

North Arcot ...	... Arni	28
	Cheyyar	26
	Wandiwash	31
	Polur	26
	Chengam	27
	Tiruvannamalai	31

TABLE 2-32

Criteria for classification of registration area

Quality of Registration	Birth Rate	Death Rate
Good ...	Above 30	Above 15
Fair ...	20-30	10-15
Poor ...	Below 20	Below 10

Using the above criteria the talukwise and Municipalitywise birth and death rates for 1961 have been classified and municipal and non-municipal areas with good, fair and poor registration are indicated in Tables 2-33 to 2-36. The areas have been clearly marked in the maps attached. It is seen that among non-municipal areas death registration is good in a strip covering almost the whole of North Arcot, the western parts of Chingleput and South Arcot districts and the northern parts of Tiruchirapalli district. A small strip in the middle of Ramanathapuram and Tirunelveli districts have good death registration. We find that among non-municipal areas birth registration is good in a small semi-circular strip covering Tiruppathur, Vellore and Cheyyar taluks of North Arcot and Sriperumbudur and Madurantakam taluks of Chingleput district. In the extreme west, Gudalur taluk of Nilgiris district has good birth registration. In the south, Aruppukottai taluk of Ramanathapuram district and Shencottah, Tenkasi, Tiruchendur and Koilpatti taluks of Tirunelveli district have good birth registration. In Kanyakumari district where the registration is carried out by the staff of the Health Department, the registration of births is good only in the non-municipal areas of Thovala taluk. Of all districts, Kanyakumari stands as the area where the registration is the poorest. There is considerable scope for improvement in this district so that the registration is at least on a par with other districts.

TABLE 2-33

Good and Bad Registration Areas by Districts of Madras State—Birth Rate for Non-Municipal Areas, 1961

BIRTH RATE

Sl. No.	Districts	Below 20	20 to 30	30 +
1.	Chingleput ...	Saidapet ...	Chingleput Kancheepuram Ponneri Tiruvallur Tiruttani	Madurantakam Sriperumbudur
2.	North Arcot.		Arkonam Arni Chengam Gudiyatham Polur Tiruvannamalai Walajapet Wandiwash	Cheyyar Tiruppathur Vellore
3.	South Arcot..	Kallakurichi.. Villupuram...	Chidambaram Cuddalore Gingee Tindivanam Tirukoyilur Vriddhachalam	
4.	Salem ...	Omalur ... Salem ... Tiruchengode Sankari ...	Attur Dharmapuri Harur Hosur Krishnagiri Namakkal Rasipuram Yercaud	
5.	Coimbatore...	Coimbatore.. Erode ... Palladam ... Pollachi ...	Avanashi Bhavani Dharapuram Gobichettipalayam Udumalpet	
6.	Nilgiris ...	Ootacamund.	Coonoor	Gudalur
7.	Madurai ...	Kodaikanal.. Madurai ...	Dindigul Melur Nilakottai Palani Periyakulam Tirumangalam	
8.	Tiruchirapalli.	Alangudi ... Karur ... Kulathur ... Tiruchirapalli Tirumayam	Kulithalai Lalgudi Musiri Perambalur Udaiyarpalayam	

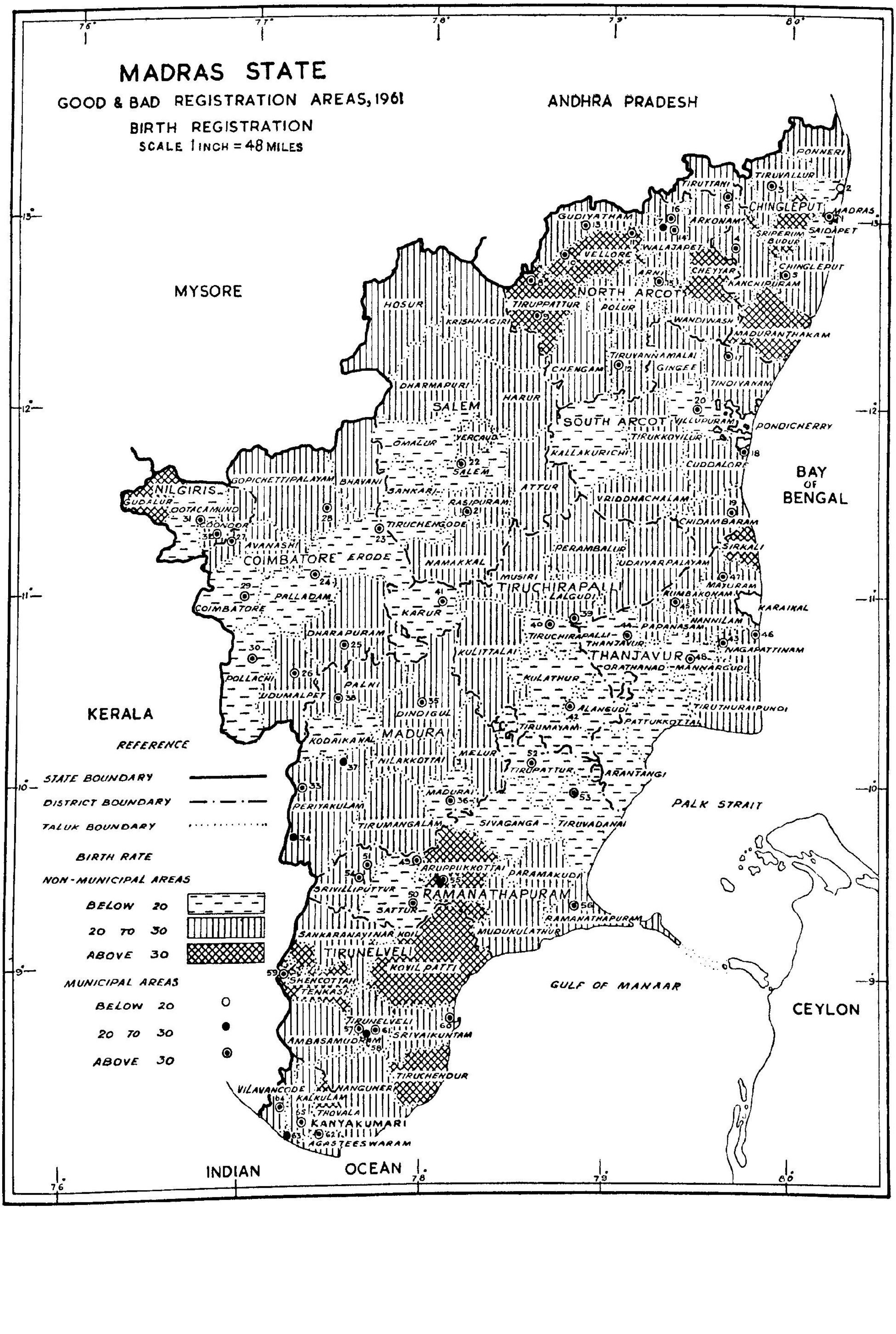

MADRAS STATE
GOOD & BAD REGISTRATION AREAS, 1961
BIRTH REGISTRATION
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
KERALA
BAY OF BENGAL
PALK STRAIT
GULF OF MANAAR
CEYLON
INDIAN OCEAN
CHINGLEPUT
NORTH ARCOT
SALEM
SOUTH ARCOT
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
THANJAVUR
MADURAI
RAMANATHAPURAM
TIRUNELVELI
KANYAKUMARI
PONDICHERRY
KARAIKAL
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
BIRTH RATE
NON-MUNICIPAL AREAS
BELOW 20
20 TO 30
ABOVE 30
MUNICIPAL AREAS
BELOW 20
20 TO 30
ABOVE 30

TABLE 2-33—(*Contd.*)

Sl. No.	Districts	Below 20	20 to 30	30 +
9.	Thanjavur ...	Arantangi ... Mannargudi.. Orthanad ... Pattukottai... Thanjavur ...	Kumbakonam Mayuram Nannilam Nagapattinam Papanasam Tiruthurai-poondi	Sirkali
10.	Ramanatha-puram.	Sattur ... Sivaganga ... Tiruppathur.. Tiruvadanai..	Mudukula-thur Paramagudi Ramanatha-puram Srivilliputhur	Aruppukkot-tai
11.	Tirunelveli ...		Ambasa-mudram Nanguneri Sankaranaya-narkoil Srivaikuntam Tirunelveli	Koilpatti Tenkasi Tiruchendur Shencottah
12.	Kanyakumari		Agasthees-waram Kalkulam Vilavancode	Thovala

TABLE 2-34

Good and Bad Registration Areas by Districts of Madras State—Birth Rate for Municipalities, 1961

BIRTH RATE

Sl. No.	Districts	Below 20	20 to 30	30 +
1.	Madras			Madras
2.	Chingleput ...	Tiruvottiyur		Kanchee-puram Tiruvallur Chingleput
3.	North Arcot..		Arcot	Vellore Tiruvanna-malai Gudiyatham Vaniyambadi Tiruppathur Walajapet Ambur Arni Arkonam Ranipet
4.	South Arcot..			Cuddalore Chidam-baram Villupuram Tindivanam

TABLE 2-34—(*Contd.*)

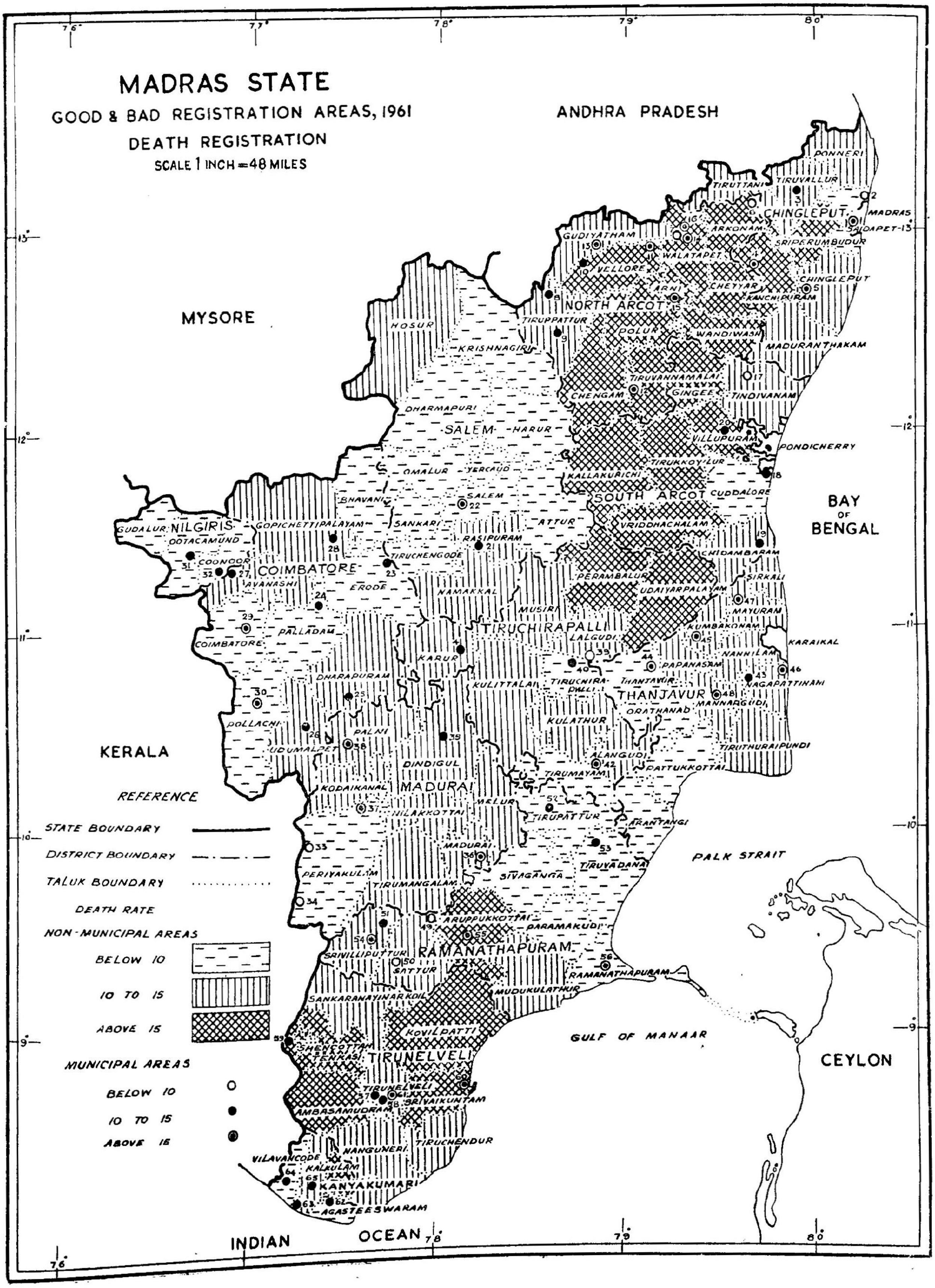
Sl. No.	Districts	Below 20	20 to 30	30 +
5.	Salem ...			Salem Rasipuram
6.	Coimbatore..			Coimbatore Erode Tiruppur Pollachi Dharapuram Udumalpet Mettu-palayam Gobichetti-palayam
7.	Nilgiris ...			Ootacamund Coonoor
8.	Madurai ...		Bodinayaka-nur Cumbum	Madurai Dindigul Periyakulam Palani
9.	Tiruchirapalli			Tiruchira-palli Karur Srirangam Pudukkottai
10.	Thanjavur ...			Thanjavur Kumbako-nam Nagapatti-nam Mayuram Mannargudi Tiruvarur
11.	Ramanatha-puram			Rajapalayam Srivilliputhur Virudhunagar Karaikudi Devakottai Sivakasi Aruppuk-kottai Ramanatha-puram
12.	Tirunelveli ...	Melapalayam.		Tuticorin Tirunelveli Palayam-kottai Shencottah
13.	Kanyakumari		Colachel	Nagercoil Kuzhithurai Padmanabha-puram

TABLE 2–35

Good and Bad Registration Areas by Districts of Madras State—Death Rate for Non-Municipal Areas, 1961

DEATH RATE

Sl. No.	Districts	Below 10	10 to 15	15 +
1.	Chingleput	Saidapet	Chingleput Madurantakam Ponneri Tiruvallur Tiruttani	Kancheepuram Sriperumbudur
2.	North Arcot		Gudiyatham Tiruppathur	Arkonam Arni Chengam Cheyyar Polur Tiruvannamalai Vellore Walajapet Wandiwash
3.	South Arcot	Cuddalore	Chidambaram Tindivanam	Gingee Kallakurichi Tirukoyilur Villupuram Vriddhachalam
4.	Salem	Attur Dharmapuri Harur Krishnagiri Omalur Salem Tiruchengode Yercaud Sankari	Hosur Namakkal Rasipuram	
5.	Coimbatore	Bhavani Coimbatore Erode Palladam Pollachi	Avanashi Dharapuram Gobichettipalayam Udumalpet	
6.	Nilgiris	Gudalur Coonoor Ootacamund.		
7.	Madurai	Periyakulam	Dindigul Kodaikanal Madurai Melur Nilakottai Palani Tirumangalam	
8.	Tiruchirapalli	Tiruchirapalli Tirumayam	Alangudi Karur Kulathur Kulithalai Lalgudi Musiri	Perambalur Udaiyarpalayam
9.	Thanjavur	Arantangi Orthanad Pattukottai Thanjavur	Kumbakonam Mannargudi Mayuram Nannilam Nagapattinam Papanasam Sirkali Tiruthuraipoondi	
10.	Ramanathapuram	Paramagudi Ramanathapuram Sivaganga Tiruppathur Tiruvadanai	Mudukulathur Sattur Srivilliputhur	Aruppukkottai
11.	Tirunelveli		Nanguneri Sankaranayanarkoil Tirunelveli Tiruchendur	Ambasamudram Koilpatti Srivaikuntam Tenkasi Shencottah
12.	Kanyakumari	Agastheeswaram Vilavancode	Kalkulam	Thovala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NON-MUNICIPAL AREAS
BELOW 10
10 TO 15
ABOVE 15
MUNICIPAL AREAS
BELOW 10
10 TO 15
ABOVE 15
CHINGLEPUT
NORTH ARCOT
SOUTH ARCOT
SALEM
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
THANJAVUR
MADURAI
RAMANATHAPURAM
TIRUNELVELI
KANYAKUMARI
MADRAS
PONDICHERRY
KARAIKAL
PONNERI
TIRUVALLUR
TIRUTTANI
SAIDAPET
SRIPERUMBUDUR
ARKONAM
WALAJAPET
GUDIYATHAM
VELLORE
ARNI
CHEYYAR
KANCHIPURAM
CHINGLEPUT
TIRUPPATTUR
POLUR
WANDIWASH
MADURANTHAKAM
HOSUR
KRISHNAGIRI
DHARMAPURI
HARUR
TIRUVANNAMALAI
CHENGAM
GINGEE
TINDIVANAM
VILLUPURAM
TIRUKKOYILUR
KALLAKURICHI
CUDDALORE
OMALUR
YERCAUD
BHAVANI
SALEM
GUDALUR
OOTACAMUND
COONOOR
GOPICHETTIPALAYAM
SANKARI
ATTUR
RASIPURAM
VRIDDHACHALAM
CHIDAMBARAM
TIRUCHENGODE
AVANASHI
ERODE
NAMAKKAL
PERAMBALUR
UDAIYARPALAYAM
SIRKALI
MAYURAM
MUSIRI
PALLADAM
COIMBATORE
KUMBAKONAM
LALGUDI
KARUR
PAPANASAM
NANNILAM
DHARAPURAM
KULITTALAI
TIRUCHIRAPALLI
THANJAVUR
NAGAPATTINAM
MANNARGUDI
ORATHANAD
POLLACHI
KULATHUR
PALNI
UDUMALPET
DINDIGUL
ALANGUDI
TIRUTHURAIPUNDI
TIRUMAYAM
PATTUKKOTTAI
KODAIKANAL
NILAKKOTTAI
MELUR
TIRUPATTUR
ARANTANGI
MADURAI
TIRUVADANAI
PERIYAKULAM
SIVAGANGA
TIRUMANGALAM
ARUPPUKKOTTAI
PARAMAKUDI
SRIVILLIPUTTUR
SATTUR
RAMANATHAPURAM
SANKARANAYINARKOIL
MUDUKULATHUR
KOVILPATTI
SHENCOTTAH
TENKASI
TIRUNELVELI
SRIVAIKUNTAM
AMBASAMUDRAM
NANGUNERI
TIRUCHENDUR
VILAVANCODE
KALKULAM
AGASTEESWARAM
76°
77°
78°
79°
80°
9°
10°
11°
12°
13°

TABLE 2-36

Good and Bad Registration Areas by Districts of Madras State—Death Rate for Municipalities, 1961

DEATH RATE

Sl. No.	Districts	Below 10	10 to 15	15 +
1.	Madras ...			Madras
2.	Chingleput ...	Tiruvottiyur..	Tiruvallur	Kancheepuram Chingleput
3.	North Arcot..	Arkonam ... Arcot ...	Vaniyambadi Tiruppathur Ambur	Vellore Tiruvannamalai Gudiyatham Walajapet Arni Ranipet
4.	South Arcot	Tindivanam	Cuddalore Chidambaram Villupuram	
5.	Salem ...		Rasipuram	Salem
6.	Coimbatore		Erode Tiruppur Dharapuram Udumalpet Mettupalayam Gobichettipalayam	Coimbatore Pollachi
7.	Nilgiris ...		Ootacamund. Coonoor	
8.	Madurai ...	Bodinayakkanur Cumbum	Dindigul	Madurai Periyakulam Palani
9.	Tiruchirapalli	Srirangam ...	Tiruchirapalli Karur	Pudukottai
10.	Thanjavur ...		Tiruvarur	Thanjavur Kumbakonam Nagapattinam Mayuram Mannargudi
11.	Ramanathapuram	Virudhunagar. Sivakasi ...	Srivilliputhur Karaikudi Devakottai	Rajapalayam Aruppukkottai Ramanathapuram
12.	Tirunelveli ...		Tirunelveli Melapalayam Shencottah	Tuticorin Palayamkottai
13.	Kanyakumari		Nagercoil Colachel Kuzhithurai Padmanabhapuram	

Death rates for municipal and non-municipal towns after weeding

One way of looking at the vital statistics where such statistics are deficient is to find the areas where they are good, fair and poor and then formulate our judgements on the basis of the available material after weeding. By weeding is meant the process of elimination of areas where the registration is confirmed to be poor. This requires a pre-conceived idea of what should be the correct registration and is open to the question that where subjective judgement is involved, bias is likely to creep in. A demographer cannot escape this criticism, since his very tool when beset with deficient or scanty data is his judgement and it is with this reservation that we have attempted the analysis here.

Our first basic assumption is that a birth rate of 35 is appropriate in the Madras State and wherever the birth registration is poor, death registration should also be poor. When the true birth rate is 35, it could vary in individual cases by a small margin and therefore we have assumed that any birth rate of over 30 should be accepted. When we once accept the birth rate of a particular town as probably correct or in other words, when we accept that the birth registration in a particular town is good, there is no reason why we should reject the death rate for the same town as bad.

Thus we proceed to accept all the towns with a birth rate of over 30 as 'better' registration towns and work out the corresponding death rates for these towns.

TABLE 2-37

Vital Statistics for Towns, Madras State, 1951–61

Towns	Population		Average population	Births during	Deaths during	B.R.	D.R.
	1951	1961	1951–61	1951–60	1951–60	1951–60	1951–60
Madras ...	1,416,056	1,729,141	1,572,599	653,190	371,286	41.5	23.6
Kancheepuram ...	84,810	92,714	88,762	35,361	19,553	39.8	22.0
Tiruvallur ...	18,847	19,757	19,302	7,562	3,648	39.2	18.9
Chingleput ...	22,660	25,977	24,319	14,113	5,090	58.0	20.9
Tiruvottiyur ...	22,393	37,571	29,982	2,965	3,134	9.9	10.5
Poonamallee ...	20,677	11,900	16,289	5,494	2,167	33.7	13.3
Uthiramerur ...	12,128	13,879	13,004	3,935	2,455	30.3	18.9
Alandur ...	15,610	22,112	18,861	3,053	1,778	16.2	9.4
Pallavaram ...	11,941	16,253	14,097	2,035	827	14.4	5.9
Tirukkalikunram ...	11,407	12,881	12,144	2,345	1,305	19.3	10.7
Madurantakam ...	9,216	13,968	11,592	3,054	1,714	26.3	14.8
Walajabad ...	6,995	8,304	7,650	2,419	1,159	31.6	15.2
Cheyyar ...	5,446	6,626	6,036	1,938	899	32.1	14.9
Arni ...	6,203	7,089	6,646	1,566	859	23.6	12.9
St. Thomas Mount ...	15,125	15,790	15,458	3,303	802	21.4	5.2
Villivakkam ...	11,364	15,203	13,284	1,214	1,177	9.1	8.9
Sriperumbudur ...	6,850	7,085	6,968	1,480	1,034	21.2	14.8
Tambaram ...	18,574	33,500	26,037	3,419	551	13.1	2.1
Kunrathur ...	10,593	12,244	11,419	1,939	951	17.0	8.3
Ponneri ...	6,903	7,740	7,322	391	278	5.3	3.8
Vellore ...	106,024	113,742	109,883	58,653	27,638	53.4	25.2
Tiruvannamalai ...	40,718	46,441	43,580	16,762	7,594	38.5	17.4
Gudiyatham ...	45,667	50,384	48,026	18,862	7,907	39.3	16.5
Vaniyambadi ...	38,712	42,048	40,380	14,067	5,726	34.8	14.2
Tirupattur ...	27,003	30,799	28,901	14,379	4,845	49.8	16.8
Walajapet ...	12,601	13,179	12,890	5,664	2,408	43.9	18.7

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951–61—(*Contd.*)

Towns		Population		Average population	Births during	Deaths during	B.R.	D.R.
		1951	1961	1951–61	1951–60	1951–60	1951–60	1951–60
Ambur	...	39,992	39,455	39,724	14,382	4,991	36.2	12.6
Arni	...	24,567	31,351	27,959	13,384	5,899	47.9	21.1
Arkonam	...	23,032	30,658	26,845	5,782	2,105	21.5	7.8
Arcot	...	21,124	25,029	23,077	5,211	1,937	22.6	8.4
Ranipet	...	18,945	22,974	20,960	9,085	3,815	43.3	18.2
Tiruvottiyur	...	14,411	15,386	14,899	4,615	2,914	31.0	19.6
Polur	...	16,088	14,764	15,426	3,477	1,836	22.5	11.9
Visharam	...	13,460	14,441	13,951	3,292	1,641	23.6	11.8
Pernampet	...	18,243	19,515	18,879	3,011	1,009	15.9	5.3
Sholingur	...	10,943	11,480	11,212	2,780	1,338	24.8	11.9
Pallikonda	...	10,773	10,578	10,676	2,922	1,426	27.4	13.4
Wandiwash	...	12,033	12,546	12,290	2,727	1,329	22.2	10.8
Kalambur	...	9,665	9,343	9,504	3,599	2,002	37.9	21.1
Chetpet	...	10,621	10,929	10,775	3,135	1,750	29.1	16.2
Kaveripakkam	...	8,540	7,893	8,217	2,491	1,223	30.3	14.9
Panappakkam	...	5,050	5,370	5,210	1,800	895	34.5	17.2
Cuddalore	...	69,084	79,168	74,126	34,682	12,717	46.8	17.2
Chidambaram	...	34,732	40,694	37,713	17,662	6,731	46.8	17.8
Villupuram	...	35,684	43,496	39,590	17,445	6,274	44.1	15.8
Tindivanam	...	29,651	34,342	31,997	10,975	4,480	34.3	14.0
Panruti	...	14,584	18,754	16,669	3,599	1,451	21.6	8.7
Portonovo	...	15,084	15,139	15,112	3,307	1,451	21.9	9.6
Nellikuppam	...	20,695	22,168	21,432	4,012	1,601	18.7	7.5
Tirukoyilur	...	16,695	13,739	15,217	7,607	2,461	50.0	16.2
Pennadam	...	6,787	7,316	7,052	2,219	1,137	31.5	16.1
Kurinjipadi	...	9,947	12,185	11,066	1,512	542	13.7	4.9

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns		Population		Average population	Births during	Deaths during	B.R.	D.R.
		1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Mannargudi	...	10,270	11,767	11,019	2,041	960	18.5	8.7
Vriddhachalam	...	11,362	14,350	12,856	2,938	1,237	22.9	9.6
Bhuvanagiri	...	10,287	11,237	10,762	1,733	1,178	16.1	10.9
Kallakurichi	...	11,073	13,312	12,193	1,917	1,128	15.7	9.3
Chinnasalem	...	9,680	10,485	10,083	1,781	754	17.7	7.5
Valavanur	...	8,298	10,167	9,233	2,177	941	23.6	10.2
Srimushnam	...	6,696	7,354	7,025	1,961	1,162	27.9	16.5
Ulundurpet	...	6,854	7,070	6,962	1,664	991	23.9	14.2
Salem	...	202,335	249,145	225,740	86,850	37,709	38.5	16.7
Rasipuram	...	23,125	23,871	23,498	7,366	2,827	31.3	12.0
Edapadi	...	23,437	24,366	23,902	2,434	922	10.2	3.9
Dharmapuri	...	24,094	28,031	26,063	3,964	1,505	15.2	5.8
Komarapalayam	...	9,892	24,757	17,325	2,857	936	16.5	5.4
Tiruchengode	...	19,228	21,386	20,307	2,628	1,351	12.9	6.7
Mettur Township	...	27,002	27,698	27,350	6,521	1,533	23.8	5.6
Taramangalam	...	9,251	9,243	9,247	1,781	476	19.3	5.1
Attur	...	22,844	29,018	25,931	7,074	2,166	27.3	8.4
Kaveripakkam	...	8,153	9,416	8,785	2,294	1,025	26.1	11.7
Sendamangalam	...	15,407	15,320	15,364	2,967	1,417	19.3	9.2
Harur	...	6,366	9,075	7,721	2,031	978	26.3	12.7
Namakkal	...	16,830	19,935	18,383	2,808	1,439	15.3	7.8
Hosur	...	8,712	11,683	10,198	2,933	1,504	28.8	14.7
Jalakandapuram	...	8,491	9,136	8,814	2,022	575	22.9	6.5
Krishnagiri	...	19,774	23,827	21,801	6,228	2,541	28.6	11.7
Omalur	...	6,480	7,151	6,816	491	186	7.2	2.7
Denkanikottai	...	8,913	11,215	10,064	2,809	969	27.9	9.6

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns		Population		Average population	Births during	Deaths during	B.R.	D.R.
		1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Mallasamudram	...	10,985	10,720	10,853	1,899	728	17.5	6.7
Coimbatore	...	197,755	286,305	242,030	116,878	47,628	48.3	19.7
Erode	...	57,576	73,762	65,669	29,321	10,515	44.6	16.0
Tiruppur	...	52,479	79,773	66,126	26,627	8,747	40.3	13.2
Pollachi	...	41,744	54,369	48,057	20,665	9,353	43.0	19.5
Dharapuram	...	24,163	26,490	25,327	9,925	3,541	39.2	14.0
Udumalpet	...	23,309	28,345	25,827	13,557	4,066	52.5	15.7
Mettupalayam	...	27,516	36,496	32,006	12,473	3,814	39.0	11.9
Gobichettipalayam	...	30,354	27,004	28,679	8,341	3,272	29.1	11.4
Kurichi	...	20,579	28,407	24,493	3,561	1,381	14.5	5.6
Kottur	...	14,435	19,862	17,149	2,958	1,388	17.2	8.1
Palladam	...	9,238	9,806	9,522	1,818	824	19.1	8.7
Bhavani	...	12,133	15,860	13,997	3,539	1,849	25.3	13.2
Avanashi	...	7,986	9,796	8,891	2,177	1,071	24.5	12.0
Vellalore	...	11,695	13,277	12,486	3,201	1,249	25.6	10.0
Singanallur	...	19,852	24,674	22,263	3,294	2,011	14.8	9.0
Satyamangalam	...	14,018	19,236	16,627	4,216	1,389	25.4	8.4
Sulur	...	8,464	9,903	9,184	1,796	500	19.6	5.4
Kuniamuthur	...	15,042	17,327	16,185	1,670	631	10.3	3.9
Peelamedu	...	13,947	18,437	16,192	1,830	1,132	11.3	7.0
Annur	...	8,305	8,884	8,595	1,898	808	22.1	9.4
Anamalai	...	10,348	11,072	10,710	2,812	970	26.3	9.1
Vettaikaranpudur	...	13,254	14,515	13,885	1,713	626	12.3	4.5
Ootacamund	...	41,370	50,140	45,755	19,671	6,905	43.0	15.1
Coonoor	...	23,902	30,690	27,296	12,424	4,255	45.5	15.6
Kotagiri	...	13,011	15,509	14,260	3,968	1,699	27.8	11.9

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns	Population		Average population	Births during	Deaths during	B.R.	D.R.
	1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Wellington ...	10,714	12,067	11,391	3,730	708	32.7	6.2
Madura ...	361,781	424,810	393,296	176,097	84,226	44.8	21.4
Dindigul ...	78,361	92,947	85,654	28,506	12,082	33.3	14.1
Bodinayakanur ...	35,912	44,914	40,413	11,380	3,981	28.2	9.9
Periyakulam ...	31,000	36,335	33,668	14,604	6,885	43.4	20.4
Palani ...	34,486	39,832	37,159	13,924	7,236	37.5	19.5
Kodaikanal ...	10,941	12,860	11,901	4,758	1,799	40.0	15.1
Cumbum ...	26,908	32,517	29,713	5,333	1,816	17.9	6.1
Gudalur ...	19,915	24,635	22,275	4,797	1,784	21.5	8.0
Thevaram ...	10,447	11,180	10,814	3,627	1,592	33.5	14.7
Chinnamanur ...	18,914	20,586	19,750	4,205	2,104	21.3	10.7
Tirumangalam ...	16,132	17,633	16,883	3,923	2,008	23.2	11.9
Uthamapalayam ...	12,506	14,110	13,308	3,964	1,660	29.8	12.5
Allinagaram ...	18,670	24,606	21,638	5,599	1,346	25.9	6.2
Sholavandan ...	13,147	14,114	13,631	2,657	1,426	19.5	10.5
Usilampatti ...	14,047	15,781	14,914	2,284	1,091	15.3	7.3
Andipatti ...	8,889	9,634	9,262	1,536	447	16.6	4.8
Kombai ...	10,641	11,317	10,979	4,099	1,822	37.3	16.6
Batlagundu ...	10,245	10,519	10,382	2,406	730	23.2	7.0
Melur ...	14,073	14,829	14,451	4,412	1,535	30.5	10.6
Natham ...	10,439	12,757	11,598	2,947	1,294	25.4	11.2
Tiruparankundram ...	9,010	18,750	13,880	1,773	1,224	12.8	8.8
Ayakudi ...	14,706	17,077	15,892	3,130	1,443	19.7	9.1
Elumalai ...	8,201	10,036	9,119	2,173	994	23.8	10.9
Nilakottai ...	6,112	7,661	6,887	1,510	680	21.9	9.9
Tiruchirapalli ...	218,921	249,862	234,392	82,237	40,327	35.1	17.2

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns		Population		Average population	Births during	Deaths during	B.R.	D.R.
		1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Karur	...	42,155	50,564	46,360	15,590	6,840	33.6	14.8
Srirangam	...	36,702	41,949	39,326	14,243	5,998	36.2	15.3
Pudukottai	...	44,527	50,488	47,508	20,245	8,487	42.6	17.9
Golden Rock R.C.	...	19,812	19,560	19,686	6,572	2,692	33.4	13.7
Golden Rock P.B.	...	18,798	23,560	21,179	1,345	676	6.4	3.2
Thathayyangarpet	...	9,195	8,960	9,078	2,363	1,248	26.0	13.7
Turaiyur	...	14,488	15,939	15,214	3,778	1,991	24.8	13.1
Lalgudi	...	12,742	13,874	13,308	5,958	1,882	44.8	14.1
Thottiyam	...	8,498	9,549	9,024	1,957	1,004	21.7	11.1
Ariyalur	...	11,006	12,658	11,832	3,030	1,560	25.6	13.2
Perambalur	...	9,374	11,168	10,271	3,173	1,845	30.9	18.0
Palapatti	...	9,542	11,309	10,426	2,400	1,217	23.0	11.7
Kulithalai	...	11,796	13,755	12,776	2,488	1,471	19.5	11.5
Udayarpalayam	...	7,276	7,524	7,400	2,513	1,609	34.0	21.7
Marupatti	...	7,200	6,626	6,913	2,157	1,263	31.2	18.3
Musiri	...	10,648	13,001	11,825	2,508	1,283	21.2	10.8
Jayangonda Cholapuram	...	11,829	13,531	12,680	2,733	1,537	21.6	12.1
Manachanallur	...	7,461	10,050	8,756	1,616	1,124	18.5	12.8
Manapparai	...	8,770	11,644	10,207	2,597	1,154	25.4	11.3
Varpattu	...	5,540	5,333	5,437	1,140	687	21.0	12.6
Ponnamaravathi	...	7,779	9,027	8,403	2,080	526	24.8	6.3
Aravankurichi	...	5,184	5,489	5,337	1,372	768	25.7	14.4
Punchaipugalur	...	8,532	9,983	9,258	1,008	439	10.9	4.7
Kattuputhur	...	6,871	7,516	7,194	1,991	939	27.7	13.1
Poovalur	...	5,449	6,135	5,792	994	619	17.2	10.7
Labbaikudikadu	...	5,969	4,638	5,304	2,224	1,084	41.9	20.4

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns	Population		Average population	Births during	Deaths during	B. R.	D. R.
	1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Thanjavur ...	100,680	111,099	105,890	51,161	22,270	48.3	21.0
Kumbakonam ...	91,643	92,581	92,112	44,264	16,334	48.1	17.7
Nagapattinam ...	57,854	59,063	58,459	25,804	11,632	44.1	19.9
Mayuram ...	43,436	51,393	47,415	22,906	7,759	48.3	16.4
Mannargudi ...	29,860	33,558	31,709	19,528	7,623	61.6	24.0
Tiruvarur ...	27,251	30,137	28,694	13,089	4,480	45.6	15.6
Vedaranyam ...	16,945	18,033	17,489	3,961	2,408	22.6	13.8
Sirkali ...	15,275	19,531	17,403	8,924	2,936	51.3	16.9
Papanasam ...	8,753	9,705	9,229	2,242	1,331	24.3	14.4
Tranquebar ...	15,016	14,754	14,885	2,557	1,513	17.2	10.2
Kuttalam ...	7,706	8,519	8,113	3,980	1,537	49.1	18.9
Tiruvadaimarudur ...	14,240	9,194	11,717	2,753	1,281	23.5	10.9
Pattukottai ...	18,246	24,726	21,486	3,530	1,458	16.4	6.8
Adirampattinam ...	13,074	13,309	13,192	3,735	1,956	28.3	14.8
Ayyampettai ...	9,352	9,618	9,485	2,833	1,458	29.9	15.4
Tiruvaiyaru ...	11,336	11,171	11,254	2,096	1,281	18.6	11.4
Vallam ...	8,720	8,273	8,497	1,705	1,207	20.1	14.2
Tiruthuraipoondi ...	11,107	13,508	12,308	5,842	1,619	47.5	13.2
Muthupet ...	9,738	11,247	10,493	1,998	1,174	19.0	11.2
Tirukattupalli ...	6,938	8,038	7,488	4,033	710	53.9	9.5
Kuthanallur ...	11,909	13,948	12,929	2,497	1,431	19.3	11.1
Tirumullaivasal ...	5,903	7,326	6,615	2,565	1,298	38.8	19.6
Valangaiman ...	6,036	6,910	6,473	3,028	992	46.8	15.3
Arantangi ...	8,219	10,258	9,239	1,448	767	15.7	8.3
Nannilam ...	7,416	7,874	7,645	4,340	1,493	56.8	19.5

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns		Population		Average population	Births during	Deaths during	B. R.	D. R.
		1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Kodavasal	...	7,210	8,148	7,679	2,560	1,026	33.3	13.4
Orthanad	...	5,035	7,152	6,094	1,225	394	20.1	6.5
Rajapalayam	...	60,861	71,203	66,032	20,976	10,314	31.8	15.6
Srivilliputhur	...	40,436	46,816	43,626	15,693	8,511	36.0	19.5
Virudhunagar	...	46,309	54,827	50,568	24,413	8,097	48.3	16.0
Karaikudi	...	38,453	43,698	41,076	15,103	6,040	36.8	14.7
Devakottai	...	25,989	25,524	25,757	10,910	4,453	42.4	17.3
Sivakasi	...	22,674	30,690	26,682	10,016	4,247	37.5	15.9
Aruppukottai	...	48,554	50,200	49,377	19,631	9,923	39.8	20.1
Ramanathapuram	...	24,053	26,890	25,472	12,634	4,319	49.6	17.0
Paramakudi	...	22,257	25,368	23,813	10,375	2,853	43.6	12.0
Ilayankudi	...	14,741	14,433	14,587	4,177	1,137	28.6	7.8
Sivaganga	...	14,306	15,642	14,974	5,851	2,812	39.1	18.8
Tiruppathur	...	15,532	14,510	15,021	4,657	1,593	31.0	10.6
Abiramam	...	10,594	6,635	8,615	1,578	645	18.3	7.5
Kamudi	...	9,455	10,017	9,736	2,446	1,054	25.1	10.8
Watrap	...	9,595	11,383	10,489	2,523	1,215	24.1	11.6
Seithur	...	10,515	11,685	11,100	1,888	859	17.0	7.7
Rameswaram	...	5,419	6,801	6,110	3,393	1,464	55.5	24.0
Sathur	...	13,565	15,759	14,662	2,565	1,364	17.5	9.3
Manamadurai	...	9,106	10,574	9,840	2,174	1,057	22.1	10.7
Tiruppuvanam	...	9,677	10,226	9,952	2,110	1,417	21.2	14.2
Tondi	...	12,006	6,422	9,214	2,166	827	23.5	9.0
Kondanur	...	6,000	5,644	5,822	1,828	678	31.4	11.6
Pallathur	...	5,581	5,560	5,571	1,224	563	22.0	10.1

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns		Population		Average population	Births during	Deaths during	B. R.	D. R.
		1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Kilakarai	...	16,188	16,860	16,524	2,891	883	17.5	5.3
Emaneswaram	...	7,818	9,153	8,486	1,527	908	18.0	10.7
Palayampatti	...	6,197	5,777	5,987	2,204	1,965	36.8	32.8
Nattarasankottai	...	5,789	4,511	5,150	3,247	960	63.0	18.6
Kottaiyur	...	5,846	5,778	5,812	876	530	15.1	9.1
Mallinkinar	...	5,826	5,935	5,881	2,107	1,553	35.8	26.4
Singampunari	...	5,714	6,471	6,093	1,207	573	19.8	9.4
Tuticorin	...	98,866	124,230	111,548	40,357	20,441	36.2	18.3
Tirunelveli	...	73,476	87,988	80,732	28,988	14,406	35.9	17.8
Palayamkottai	...	40,010	51,002	45,506	25,162	10,736	55.3	23.6
Melapalayam	...	37,653	38,806	38,230	7,153	4,519	18.7	11.8
Shencottah	...	17,332	20,528	18,930	7,268	3,026	38.4	16.0
Tenkasi	...	31,074	34,403	32,739	8,548	3,570	26.1	10.9
Kadayanallur	...	38,060	41,249	39,655	7,761	2,933	19.6	7.4
Puliangudi	...	27,619	30,648	29,134	4,105	1,911	14.1	6.6
Kalladaikurichi	...	20,019	20,232	20,126	4,565	3,209	22.7	15.9
Viravanallur	...	17,968	16,554	17,261	5,505	4,047	31.9	23.4
Cheranmahadevi	...	10,051	10,309	10,180	2,722	1,942	26.7	19.1
Ambasamudram	...	20,356	22,447	21,402	6,839	3,142	32.0	14.7
Tiruchendur	...	13,214	15,182	14,198	5,765	3,040	40.6	21.4
Sivagiri	...	16,602	17,852	17,227	3,620	1,821	21.0	10.6
Udangudi	...	13,485	15,267	14,376	4,034	1,526	28.1	10.6
Vasudevanallur	...	12,897	13,250	13,074	2,654	1,191	20.3	9.1
Surandai	...	14,494	15,070	14,782	5,101	2,490	34.5	16.8
Kulasekarapattinam	...	10,029	10,679	10,354	2,067	1,513	20.0	14.6

TABLE 2-37—(*Contd.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Contd.*)

Towns		Population		Average population	Births during	Deaths during	B. R.	D. R.
		1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Koilpatti	...	26,038	33,305	29,672	5,917	2,404	19.9	8.1
Srivaikuntam	...	11,501	12,590	12,046	2,430	1,564	20.2	13.0
Nanguneri	...	9,516	5,937	7,727	3,540	2,007	45.8	26.0
Sankarankoil	...	21,904	24,089	22,997	4,726	1,812	20.6	7.9
Tachanallur	...	9,790	12,252	11,021	2,503	1,990	22.7	18.1
Ettayapuram	...	9,470	10,135	9,803	2,446	1,376	25.0	14.0
Kayalpattinam	...	11,302	13,432	12,367	3,291	1,681	26.6	13.6
Vikramasingapuram	...	29,361	32,978	31,170	5,878	2,903	18.9	9.3
Vadakkuvalliyur	...	9,146	11,434	10,290	3,153	1,398	30.6	15.6
Sathankulam	...	9,303	10,974	10,139	2,957	1,267	29.2	12.5
Pattamadai	...	8,798	9,552	9,175	1,587	1,132	17.3	12.3
Alwarthirunagari	...	6,654	6,753	6,704	1,650	1,091	24.6	16.3
Tisayanvilai	...	11,817	13,758	12,788	5,066	1,730	39.6	13.5
Kalugumalai	...	6,199	7,403	6,801	2,240	1,464	32.9	21.5
Kayathar	...	5,516	5,168	5,342	1,840	926	34.4	17.3
Eral	...	5,479	6,446	5,963	1,665	1,161	27.9	19.5
Kadambur	...	7,128	6,648	6,888	1,419	753	20.6	10.9
Kalakad	...	16,312	18,483	17,398	2,235	1,202	12.8	6.9
Panagudi	...	11,551	13,265	12,408	3,615	1,698	29.1	13.7
Sawyerpuram	...	7,631	8,060	7,846	1,967	874	25.1	11.1
Arumuganeri	...	13,801	14,904	14,353	560	392	3.9	2.7
Achamputhur	...	6,092	6,812	6,452	2,294	1,198	35.6	18.6
Nagercoil	...	79,284	106,207	92,746	27,140	8,020	29.3	8.6
Samboorvadakarai	...	8,564	9,721	9,143	3,146	1,644	34.4	18.0
Colachel	...	13,606	15,673	14,640	4,822	1,310	32.9	8.9

TABLE 2-37—(*Concld.*)

Vital Statistics for Towns, Madras State, 1951-61—(*Concld.*)

Towns		Population		Average Population	Births during	Deaths during	B. R.	D. R.
		1951	1961	1951-61	1951-60	1951-60	1951-60	1951-60
Kuzhithurai	...	10,860	13,708	12,284	4,700	1,106	38.3	9.0
Padmanabhapuram	...	13,397	14,491	13,944	3,678	1,432	26.4	10.3
Aramboli	...	7,638	10,913	9,276	3,302	1,528	35.6	16.5
Boothapandi	...	6,469	12,309	9,389	2,570	1,014	27.4	10.8
Kanyakumari	...	5,218	13,101	9,160	2,814	1,084	30.7	11.8
Eraniel	...	9,113	23,253	16,183	5,824	3,036	36.0	18.8
Kadiappattinam	...	9,537	21,604	15,571	3,316	1,048	21.3	6.7
Thiruvithamcode	...	7,450	29,668	18,559	2,850	1,064	15.4	5.7
Arumana	...	9,141	32,356	20,749	3,770	1,170	18.2	5.6
Kollancode	...	7,015	21,815	14,415	2,174	798	15.1	5.5

Out of the 248 towns for which we have vital statistics data for 1951-60, 107 towns (including municipal towns) fall under the category of 'better' registration towns. The mean birth and death rates for 1951—61 for these 107 towns were found to be 41.6 and 19.5 respectively.

It is known that the registration efficiency in both municipal and non-municipal towns are not likely to be the same and in fact the non-municipal towns are likely to have a poorer registration than the municipal towns. This can be examined further by separating out the non-municipal towns among them and working out the rates separately. We found 51 non-municipal towns falling under this category and their mean birth and death rates for 1951—60 were found to be 37.7 and 16.5 respectively. An over view of the computations can be had from the following table.

TABLE 2-38

Birth and Death Rates in Towns after Weeding

		No.	Mean Population 1951-61	Births 1951-60	Deaths 1951-60	B. R.	D. R.
All Towns	...	268	7,882,176	2,787,225	1,297,649	35.3	16.5
Better Regn. Towns :							
Municipal	...	56	4,981,914	2,094,856	989,070	42.0	19.9
Non-Municipal	...	51	542,783	204,703	89,366	37.7	16.5
Total	...	107	5,524,697	2,299,559	1,078,436	41.6	19.5

This table shows that the death rate after ' weeding ' works out to 19.5 in urban areas with 19.9 in municipal areas and 16.5 in non-municipal areas. There is likely to be some inflation of the figures of municipal areas due to deaths occurring to non-residents in these areas, but the figures for non-municipal towns even after weeding may be somewhat under counted due to large scale omissions in these areas. In spite of the provision for licensing of burial grounds in municipal areas, the reports of the Director of Public Health show that this provision is not strictly enforced, and as a result several unauthorised burial areas exist in a number of municipalities. Therefore, even in municipalities, the possibility of omission of deaths cannot be ruled out, whereas this is quite patent in the non-municipal urban areas.

It is, therefore, not possible to assess clearly the resultant effect of inflation due to non-resident deaths and the opposite tendency of omissions to register even in the admittedly good registration areas and therefore the net effect of these factors cannot be fixed in quantitative terms. However it appears probable that the death rate arrived at after weeding should be close to reality and a death rate of 19.5 can be accepted.

Rural Areas

Talukwise particulars are not presented in the reports on Health Conditions of Madras State published by the Director of Public Health, Madras, even though this will involve only a small additional effort to compile such information. Therefore, it was not possible for us to build up the data for the ten year period 1951 to 1961. However we have attempted the compilation of such information for Non-Municipal areas talukwise for 1961, by culling out the relevant information from the three returns (Original, Supplement-I and Supplement-II) maintained for each taluk. The figures for rural areas of each taluk are obtained by deducting the figures for the Census towns from the non-municipal particulars. The figures are presented in Table 2-39.

TABLE 2-39

Talukwise particulars of Births and Deaths for Rural Areas, 1961

Taluk	Population	Births	Deaths	B. R.	D. R.
1. Ponneri ...	215,971	4,786	2,384	22.2	11.0
2. Tiruvallur ...	250,657	5,973	3,104	23.8	12.4
3. Tiruttani ...	193,526	4,549	2,310	23.5	11.9
4. Sriperumbudur ...	204,498	5,886	3,507	28.8	17.2
5. Saidapet ...	253,457	3,064	1,766	12.1	7.0
6. Chingleput ...	207,219	6,270	3,090	30.3	14.9
7. Kancheepuram ...	207,170	5,966	3,941	28.8	19.0
8. Madurantakam ...	263,033	8,352	4,040	31.8	15.4
9. Arkonam ...	209,603	5,886	3,488	28.1	16.6
10. Walajapet ...	275,055	8,250	4,893	30.0	17.8
11. Gudiyatham ...	315,329	7,867	3,628	24.9	11.5
12. Tiruppathur ...	334,737	10,398	4,002	31.1	12.0
13. Vellore ...	245,698	7,632	3,727	31.1	15.2
14. Arni ...	138,488	3,909	3,904	28.2	28.2
15. Cheyyar ...	194,470	6,092	5,113	31.3	26.3
16. Wandiwash ...	208,751	5,251	6,577	25.2	31.5
17. Polur ...	210,756	5,853	5,741	27.8	27.2

TABLE 2-39—(*Contd.*)

Talukwise particulars of Births and Deaths for Rural Areas, 1961—(*Contd.*)

Taluk		Population	Births	Deaths	B. R.	D. R.
18. Chengam	...	222,703	5,503	6,039	24.7	27.1
19. Tiruvannamalai	...	212,431	4,498	6,727	21.2	31.7
20. Gingee	...	254,443	5,735	5,851	22.5	23.0
21. Tindivanam	...	318,474	7,361	4,251	23.1	13.3
22. Villupuram	...	302,949	5,879	5,784	19.4	19.1
23. Tirukkoyilur	...	379,302	8,490	8,210	22.4	21.6
24. Kallakurichi	...	359,681	6,319	6,497	17.6	18.1
25. Vriddhachalam	...	331,800	7,380	5,696	22.2	17.2
26. Cuddalore	...	380,775	7,594	3,721	19.9	9.8
27. Chidambaram	...	347,806	7,218	3,733	20.8	10.7
28. Hosur	...	302,456	7,598	3,014	25.1	10.0
29. Krishnagiri	...	383,470	9,413	3,197	24.5	8.3
30. Harur	...	21,528	5,791	2,063	26.9	9.6
31. Dharmapuri	...	346,550	7,709	3,061	22.2	8.8
32. Omalur	...	371,857	5,705	2,350	15.3	6.3
33. Yercaud	...	23,753	527	215	22.2	9.1
34. Salem	...	367,468	6,562	2,979	17.9	8.1
35. Sankari	...	217,945	3,981	1,681	18.3	7.7
36. Tiruchengode	...	189,804	2,913	2,077	15.3	10.9
37. Rasipuram	...	176,818	4,159	2,080	23.5	11.8
38. Attur	...	267,493	5,231	2,586	19.6	9.7
39. Namakkal	...	384,973	7,636	5,042	19.8	13.1
40. Bhavani	...	236,640	5,843	2,079	24.7	8.8
41. Gobichettipalayam	...	355,983	9,380	3,860	26.3	10.8
42. Erode	...	437,748	7,801	4,105	17.8	9.4
43. Dharapuram	...	299,856	6,093	3,305	20.3	11.0
44. Palladam	...	291,572	5,208	2,942	17.9	10.1
45. Avanashi	...	240,525	5,867	2,850	24.4	11.8
46. Coimbatore	...	341,947	3,770	1,979	11.0	5.8

TABLE 2-39—(*Contd.*)

Talukwise particulars of Births and Deaths for Rural Areas, 1961—(*Contd.*)

Taluk		Population	Births	Deaths	B. R.	D. R.
47. Pollachi	...	327,266	6,186	3,147	18.9	9.6
48. Udumalpet	...	192,334	4,648	2,299	24.2	12.0
49. Gudalur	...	66,057	2,070	572	31.3	8.7
50. Ootacamund	...	119,498	2,172	531	18.2	4.4
51. Coonoor	...	115,347	2,643	721	22.9	6.3
52. Dindigul	...	509,600	13,780	6,728	27.0	13.2
53. Palani	...	231,900	5,492	2,857	23.7	12.3
54. Kodaikanal	...	37,850	418	398	11.0	10.5
55. Periyakulam	...	424,469	10,232	3,922	24.1	9.2
56. Nilakkottai	...	258,712	7,176	3,171	27.7	12.3
57. Melur	...	214,934	4,879	2,270	22.7	10.6
58. Madurai	...	227,090	3,894	2,345	17.1	10.3
59. Tirumangalam	...	367,232	9,476	4,995	25.8	13.6
60. Perambalur	...	270,933	7,191	4,931	26.5	18.2
61. Udaiyarpalayam	...	403,979	12,102	6,508	30.0	16.1
62. Lalgudi	...	236,173	4,992	3,409	21.1	14.4
63. Musiri	...	322,129	8,753	4,744	27.2	14.7
64. Karur	...	267,817	4,793	3,118	17.9	11.6
65. Kulithalai	...	419,956	11,024	6,071	26.3	14.5
66. Tiruchirapalli	...	167,809	2,384	1,626	14.2	9.7
67. Kulathur	...	169,300	2,601	1,959	15.4	11.6
68. Alangudi	...	139,991	2,117	1,403	15.1	10.0
69. Tirumayam	...	148,299	2,133	1,347	14.4	9.1
70. Sirkali	...	158,921	4,366	2,013	27.5	12.7
71. Mayuram	...	289,393	6,145	3,317	21.2	11.5
72. Kumbakonam	...	266,093	5,392	3,232	20.3	12.1
73. Nannilam	...	250,995	6,597	3,698	26.3	14.7
74. Papanasam	...	206,668	4,584	2,443	22.2	11.8
75. Thanjavur	...	223,069	2,982	2,136	13.4	9.6

TABLE 2-39—(*Concld.*)

Talukwise particulars of Births and Deaths for Rural Areas, 1961—(*Concld.*)

Taluk		Population	Births	Deaths	B. R.	D. R.
76. Orthanad	...	187,272	2,850	1,558	15.2	8.3
77. Mannargudi	...	224,322	4,003	2,521	17.8	11.2
78. Nagapattinam	...	190,109	4,458	2,745	23.4	14.4
79. Thiruthuraipoondi	...	232,034	5,767	3,396	24.9	14.6
80. Pattukottai	...	252,268	3,052	1,653	12.1	6.6
81. Arantangi	...	145,710	2,048	1,102	14.1	7.6
82. Tirupathur	...	231,434	3,934	2,060	17.0	8.9
83. Sivaganga	...	225,585	2,419	1,300	10.7	5.8
84. Tiruvadanai	...	185,927	2,709	1,028	14.6	5.5
85. Paramakudi	...	176,689	3,182	1,261	18.0	7.1
86. Ramanathapuram	...	141,677	2,733	866	19.3	6.1
87. Mudukulathur	...	217,471	5,877	2,273	27.0	10.5
88. Aruppukottai	...	207,394	6,444	3,373	31.1	16.3
89. Sattur	...	252,576	4,875	3,004	19.3	11.9
90. Srivilliputhur	...	208,043	5,454	2,874	26.2	13.8
91. Sankarankoil	...	250,089	6,598	3,700	26.4	14.8
92. Kovilpatti	...	350,431	12,034	6,779	34.3	19.3
93. Srivaikuntam	...	179,694	4,710	2,797	26.2	15.6
94. Tirunelveli	...	147,967	3,304	2,143	22.3	14.5
95. Tenkasi	...	244,848	7,968	4,650	32.5	19.0
96. Ambasamudram	...	181,514	4,653	3,071	25.6	16.9
97. Nanguneri	...	272,129	7,375	3,854	27.1	14.2
98. Tiruchendur	...	204,400	5,843	2,727	28.6	13.3
99. Shencottah	...	29,412	1,052	638	35.8	21.7
100. Vilavancode	...	249,672	7,273	2,359	29.1	9.4
101. Kalkulam	...	235,778	7,404	2,877	31.4	12.2
102. Thovala	...	390,070	1,327	683	3.4	1.8
103. Agastheeswaram	...	157,297	3,553	1,562	22.6	9.9

TABLE 2-40

Vital Statistics of Rural Areas with better Registration, 1961

Taluk		Population	Births	Deaths	B. R.	D. R.
1. Chingleput	...	207,219	6,270	3,090	30.3	14.9
2. Madurantakam	...	263,033	8,352	4,040	31.8	15.4
3. Walajapet	...	275,055	8,250	4,893	30.0	17.8
4. Tiruppathur	...	334,737	10,398	4,002	31.1	12.0
5. Vellore	...	245,698	7,632	3,727	31.1	15.2
6. Cheyyar	...	194,470	6,092	5,113	31.3	26.3
7. Gudalur	...	66,057	2,070	572	31.3	8.7
8. Udayarpalayam	...	403,979	12,102	6,508	30.0	16.1
9. Aruppukkottai	...	207,394	6,444	3,373	31.1	16.3
10. Koilpatti	...	350,431	12,034	6,779	34.3	19.3
11. Tenkasi	...	244,848	7,968	4,650	32.5	19.0
12. Shencottah	...	29,412	1,052	638	35.8	21.7
13. Kalkulam	...	235,778	7,404	2,877	31.4	12.2
Total	...	3,058,111	96,068	50,262	31.4	16.4

Of the 103 taluks, we find that only 13 taluks have birth rates exceeding 30. The figures are presented in Table 2-40.

It appears from the above table that even the ' better ' registered rural areas have a registered birth rate of 31.4 and death rate of 16.4 in 1961. The correct birth rate is likely to be 35 and the birth rate even after weeding is 10% short of the true birth rate. If this is used as a correction factor for correcting the death rate, we get a death rate of 18 in 1961. The death rate for the decade 1951—60 is bound to be higher and may be about 20.

We may add here a few comments on the compilation procedure adopted by the Director of Public Health. Talukwise particulars are not compiled by the Director of Public Health even though the basic material is available with them. Any Census Superintendent intending to compile such particulars has to go into the original returns since the data are not maintained talukwise. A systematic effort to improve registration has been wanting due to the failure on the part of the Director of Public Health to compile such basic information as talukwise Vital Statistics. In 1961 we have found that out of the 103 taluks, only 13 have registration which may be regarded as ' better, ' but if this had been found earlier, action could have been taken on the officials of the defaulting areas.

The responsibility for good registration in their areas should be fixed on the Tahsildars in the case of rural areas and on the Commissioners in the case of Census towns and municipalities. A systematic effort should be made by the Director of Public Health on the following lines :

Rural Areas : A statement showing the estimated mid-year population, births, deaths and birth and death rates for the rural areas of each taluk should be prepared

by the Director of Public Health every year. These figures should be examined in the light of other evidences concerning the prevalent birth and death rates and comments on the birth and death rates of each taluk should be attempted. For instance the taluks with a birth rate of less than 30 should be regarded as having poor registration and these comments should be communicated to the Board of Revenue for necessary action. Stringent action should be taken on the Tahsildars whose taluks have shown poor registration.

The existing procedure followed by the Tahsildars is to simply forward the returns of births and deaths to the Office of the Director of Public Health, without even going through them. As a consequence of such perfunctory performance on the part of the Tahsildars, the inaccuracy of the returns remains unchecked. On the contrary if only the Tahsildars had cared to scrutinise the monthly returns before forwarding them to the Director of Public Health, it would have been possible for them to find out easily those villages which are poor in registration. If each Tahsildar on detection of poor registration in a village takes sufficient immediate deterrent action on the village officials there is at least a possibility of matters improving in the subsequent months.

Tahsildars should in turn perfect a system for detection of the bad registration areas in their jurisdiction. This can be done by preparing a Registration Quality Control Chart as indicated in Table 2–41 and by watching the monthwise particulars. One way of checking whether the registration in a village for a month is poor is by working out the following Index.

TABLE 2–41

Model Registration Quality Control Chart for Taluks

Taluk :

Name of Village	Approximate Population	BIRTHS REGISTERED IN EACH MONTH												DEATHS REGISTERED IN EACH MONTH											
		J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
1.																									
2.																									
3.																									
4.																									

$$I = 1{,}000 \times \frac{\text{Number of births in the month in the given village.}}{\text{Population of the village.}}$$

If the value of this Index falls short of 2.5[1] then the Tahsildar should regard that registration is poor in that village and take the village officials to task for such poor registration. This does not involve much additional labour and could be attempted by the existing taluk revenue staff with the material that they are blindly forwarding to the Director of Public Health.

Census Towns and Municipal Areas

A similar procedure can be followed by the Commissioners of the Municipalities and Census Towns who should prepare a chart showing the monthwar births and deaths in each ward constituting their census town or municipality. The wards revealing poor registration should be bestowed special attention and the ward officials in charge of registration should be taken to task. In many of the towns where there are only dry latrine facilities, the scavenger woman visits every house daily for cleaning and no birth or death occurring in the house can escape her notice. In fact in such contingencies she offers her assistance to such house-

[1] This is worked out by dividing an annual birth rate of 30 by 12, to get the monthly birth rate.

holds in cleaning and other allied work. She should, therefore, be able to provide information on the occurrence of births and deaths in her area and a little incentive in the form of a reward to her by the municipal or census town authorities will lead to a more accurate registration.

We have indicated how the Madras Registration System has always an element of under registration, throughout its history. The relevant question for consideration is whether there is likely to be an increase in this component during the decades 1941—51 and 1951—61. The responsibility for the maintenance of registers is that of the Revenue Department in the rural parts of Madras State. In municipal areas, the work is done by the Municipal Commissioners. In non-municipal urban areas, it is done by the village staff where Act III of 1899 is in force and by the Health Assistant where the Madras District Municipalities Act has been extended. There is a possibility of the normal revenue administration having less time to devote to the accurate registration of birth and death statistics. From 1941 onwards, the Revenue Administration has worked under constant strain. Further, with the tempo of developmental activity after Independence, the attention of the Revenue Authorities has been diverted from the normal routine items of work to more important items of developmental work. The importance attached to Jamabandi and annual verification of Registers which used to be a significant event in the history of the Revenue Administration has ceased to be so important in the revised set-up. Therefore, it is likely that the maintenance of Registers has not received that attention which it used to get before 1941. The revenue official is to-day more concerned with the impact of public opinion and his dealings with public rather than the maintenance of those registers which was considered his first duty in olden days.

We have become more statistical minded and perhaps, can expect a better return from the people. But, actually, no statistical approach has been made by the Director of Public Health in compiling the birth and death returns. Till 1930 these figures were compiled in the Office of the Collector and transmitted to the Director of Public Health. To-day, they are compiled in the Office of the Director itself. Actually, the method followed is that the non-receipt of return is adjusted on a pro-rata basis. No attempt has been made by any independent statistical inquiry to classify areas as good registration and bad registration areas. No statistical attempt has been made to inform any Collector that the returns of a particular area have not been upto the standard with the result that the Office of the Director of Public Health has functioned as a collecting agency and has not applied its mind to the importance of the collection of accurate data. It is always possible to supplement the information collected by the village officers by periodical surveys conducted from time to time and no attempt has been made so far to conduct periodical studies and see that the returns are maintained in a proper manner. Perhaps it will not be too much to expect that, in future, an attempt can be made to increase the quality of registration in Madras State by the Director of Public Health taking more systematic measures in improving the areas where poor registration can be detected easily in his office.

CHAPTER III

FERTILITY—MEASURES AND TRENDS

Fertility and Fecundity

Almost every society in the world has attached considerable significance to fertility. This has manifested itself in numerous references to the social status of barren women as compared to women who have borne children. Practices designed to promote fertility such as prescriptions on the diet and sexual behaviour of pregnant women, notably abstention from sexual intercourse during the entire period, or at least during the last few months of pregnancy are common in many societies. Some stable cultures tend to promote a very high level of fertility, with almost complete absence of restraining factors. On the other hand, practices tending towards restriction of fertility are strongly marked in some other societies. In spite of the abundant interest shown on the level of fertility of individual women, the study of fertility as a group phenomena is of relatively recent origin.

Before going into the measures of fertility, it is better to specify the distinction between the terms fertility and fecundity. In present demographic usage, 'fecundity' refers to capacity to produce living offspring, whereas "fertility" refers to actual performance. A woman would be considered *fertile* if she had ever borne a child. Fecundity, on the other hand, denotes the ability to bear a child and has no reference to whether or not a woman actually has borne a child. The proportion of all women who are fecund is not known with any precision. In some societies where practically all women marry and where there is strong social pressure to bear children, it has been found that as few as 1 or 2% of those married are childless; in most groups the proportion is somewhat higher.

Sample studies of the population of India where early marriage is conventional are of particular interest to us. Unfortunately we have the results of only a limited number of field studies available to us and they are summarised in Table 3-1.

The weighted average of the proportions of childless wives in the three samples of the Hindu Population in Bengali areas is 5.3%. The proportion is much higher in the sample from a Muslim district of Calcutta, but it appears much lower in the large sample of Lucknow and Kanpur households, predominantly Hindu. A tabulation of the Family Planning Survey Schedules has revealed the percentages of sterile women shown in Table 3-2 in the 4 areas of Madras City.

TABLE 3-1

Frequency of Childless Wives in Samples of Indian Population

Particulars	No. of wives	Proportion Childless %
Bengali areas (wives aged 40 +)		
Singur (rural, Hindu) no contraception.	166	4.8
Baniatola (Calcutta, Hindu) medium economic class; slight contraception.	164	6.7
Ballygunge (Calcutta, Hindu) upper economic class, some contraception.	214	4.7
Park Circus (Calcutta, Muslim) no contraception ...	152	10.5
Lucknow & Kanpur (wives all ages, in unbroken marriages) ...	769	4.4
Mysore areas (wives aged 45 + ; uninterrupted wedlock to 45 years of age) :		
Bangalore City ...	1,164	5.4
Town ...	263	3.8
Rural Areas ...	873	5.4

Source: Frank Lorimer's Culture & Human Fertility, page 31.

TABLE 3-2

Sterility Ratios for women aged 43 years and over in Madras City. Family Planning Survey, 1963-64

Zone	Proportion sterile
I Industrial	7.5
II Commercial	12.2
III Old Residential	5.8
IV New Residential	3.7
All areas	6.8

New Residential area has the least sterility and this could be due to the higher economic status of the residents of this area. The next highest place is occupied by old residential area with 6.3% sterile. In all 296 women over 43 years of age were found in the sample, of which 20 had not borne any children. The sterility ratio for the city works out to 6.8% of the women 43 years and over. We also have material on sterility based on the Fertility Survey. The figures are presented below by religion separately for rural and urban areas.

TABLE 3-3

Proportion Sterile among women aged 43 years and above. Fertility Survey, 1961

	Rural Percentage	Urban Percentage
Hindu ...	6.6	8.4
Muslim ...	6.0	7.2
Christian ...	7.4	5.3
All Religions ...	6.6	8.1

The following conclusions emerge from this table :

(i) Sterility ratio is higher in urban area (8.1%) when compared to rural area (6.6%)

(ii) In the urban areas, Hindus have the highest sterility ratio (8.4%) and Christians the least (5.3%)

(iii) In the rural areas Christians have the highest sterility ratio (7.4%) whereas Muslims and Hindus have approximately the same sterility ratio (about 6%).

These may be kept in mind while interpreting the data on fertility discussed in this Chapter, since every measure of fertility such as the average number of children borne by women in any specified group, will be affected by the proportions of infecund couples and by the proportion of couples that are fecund but childless, as well as by the average number of children borne by the fertile couples. But in this discussion we are mainly concerned with the fertility of the group rather than of individuals.

Some common measures of fertility

The simplest measure of fertility is the crude birth rate which is calculated by relating the total live births in a year to the total population of all ages and expressing it as a rate per 1,000 persons. Symbolically, if B is the number of live births and P the average population in a given geographical area during a specified year, then the crude birth rate (B.R.) is given by

$$BR = \frac{B}{P} \times 1{,}000$$

Since the age-sex composition of population varies from one geographical area to another, a more refined measure of fertility will be to express the births in terms of the women in the reproductive age group which is usually taken as 15 to 44 or 15 to 49. If F_{15-44} denotes the women in the age group 15 to 44, then the General Fertility Rate(GFR) is given by $GFR = \frac{B}{F_{15-44}} \times 1{,}000.$

In the actual situation, fertility does not remain at the same level throughout the reproductive period and the proportion of women in the different age groups also varies from one area to another. A more dependable measure of fertility is the age specific fertility rate. Denoting by f_x the age specific fertility rate for the age group (x, x+4), F_x the number of women in that age group, B_x the number of births occurring to them in a given year, we have $f_x = \frac{B_x}{F_x} \times 1{,}000.$

Since births occur only to married women, the marital status of women introduces another source of variation in fertility. A more refined measure of fertility is therefore obtained by relating births to married women. The General Marital Fertility Rate (GMFR) is obtained from

$$GMFR = \frac{B}{F^m_{15-44}} \times 1{,}000$$

where F^m_{15-44} stands for the married females in the age group 15 to 44. Likewise, the specific marital fertility rate for the age groups (x, x+4), f^m_x is given by

$$f^m_x = \frac{B_x}{F^m_x} \times 1{,}000$$

where F^m_x denotes the number of married women in the age group (x, x + 4). The Total Fertility Rate (TFR) is defined as the sum total of the specific fertility rates for each age or 5 times that for the 5 year age groups

$$TFR = 5\Sigma f_x$$

where the summation covers all the reproductive age groups.

The crude birth rate of the population in any specific area is obtained by dividing the number of births

recorded in that area during a year by its total population, preferably the mid-year population and multiplying by 1,000, thus obtaining the number of births per 1,000 of the population. A corrected birth rate is one which is increased to allow for the fact that not all births are recorded. The decennial crude and corrected birth rates are presented below :

TABLE 3-4

Registered and estimated birth rates for Madras State

Decade		Registered Birth Rate	Corrected Birth Rate	Percentage of under registration
1921-31	...	30.4	42.8	29.0
1931-41	...	33.4	41.1	18.7
1941-51	...	30.0	35.8	16.2
1951-61	...	27.3	34.9	21.8

The age specific birth rates of an area are obtained by dividing the number of births to mothers of each age by the number of women of this age and multiplying by 1,000. To calculate this rate, the births must be recorded and tabulated by the age of the mother and by the age of all the women of child bearing ages. Births to mothers of unstated age should be distributed proportionately, and allowance should be made for unrecorded births.

The following table gives the age-specific fertility rates in 1961 in 7 selected cities for which births have been classified by age groups of mothers.

TABLE 3-5

Fertility Rate for 1,000 women in selected towns, 1961

Age Group	Madras	Vellore	Salem	Coimbatore	Madurai	Tiruchirapalli	Thanjavur
15-19 ...	141.7	215.8	168.6	142.5	69.4	108.7	193.8
20-24 ...	254.9	405.7	250.8	343.7	164.5	248.0	383.7
25-29 ...	263.1	339.6	237.4	385.2	172.2	237.1	355.3
30-34 ...	179.4	258.0	251.1	273.5	103.7	175.4	247.6
35-39 ...	89.7	204.7	284.1	160.3	78.7	84.5	115.5
40-44 ...	14.1	41.5	123.6	29.9	16.7	15.7	24.2
45 + ...	0.4	1.3	0.2	0.8	0.5	0.2	1.4
All ages.	87.9	123.4	103.0	116.3	52.3	78.4	111.5

It is seen that the fertility rate starts at a low level in the age group 15-19 and rises to its peak in either of the age groups 20-24 and 25-29. In the case of Vellore, Salem, Tiruchirapalli and Thanjavur the peak is in the age group 20-24 and in the case of Madras, Coimbatore and Madurai, the peak is observed in the 25-29 age group. The fertility rate in the age group 20-24 ranges from 165 in the case of Madurai to 384 in the case of Thanjavur, and in 25-29 the range is 172 (Madurai) to 385 (Coimbatore). A steady fall in fertility is noted in subsequent age groups and the lowest fertility rate is recorded in the age group 40-44. Leaving apart Salem which has an abnormally high rate in this age group (124), the range is 14 (Madras City) to 42 (Vellore).

These rates have been worked out with reference to the women in the respective age groups in these towns. It will be more relevant to compare the fertility rates computed with reference to currently married women in these age groups. The computation of Marital Fertility Rates as these rates are called, enable us to account for differences in the proportions of currently married women in these age groups. The figures presented below enable a comparison of these rates for the different age groups as well as among the different towns.

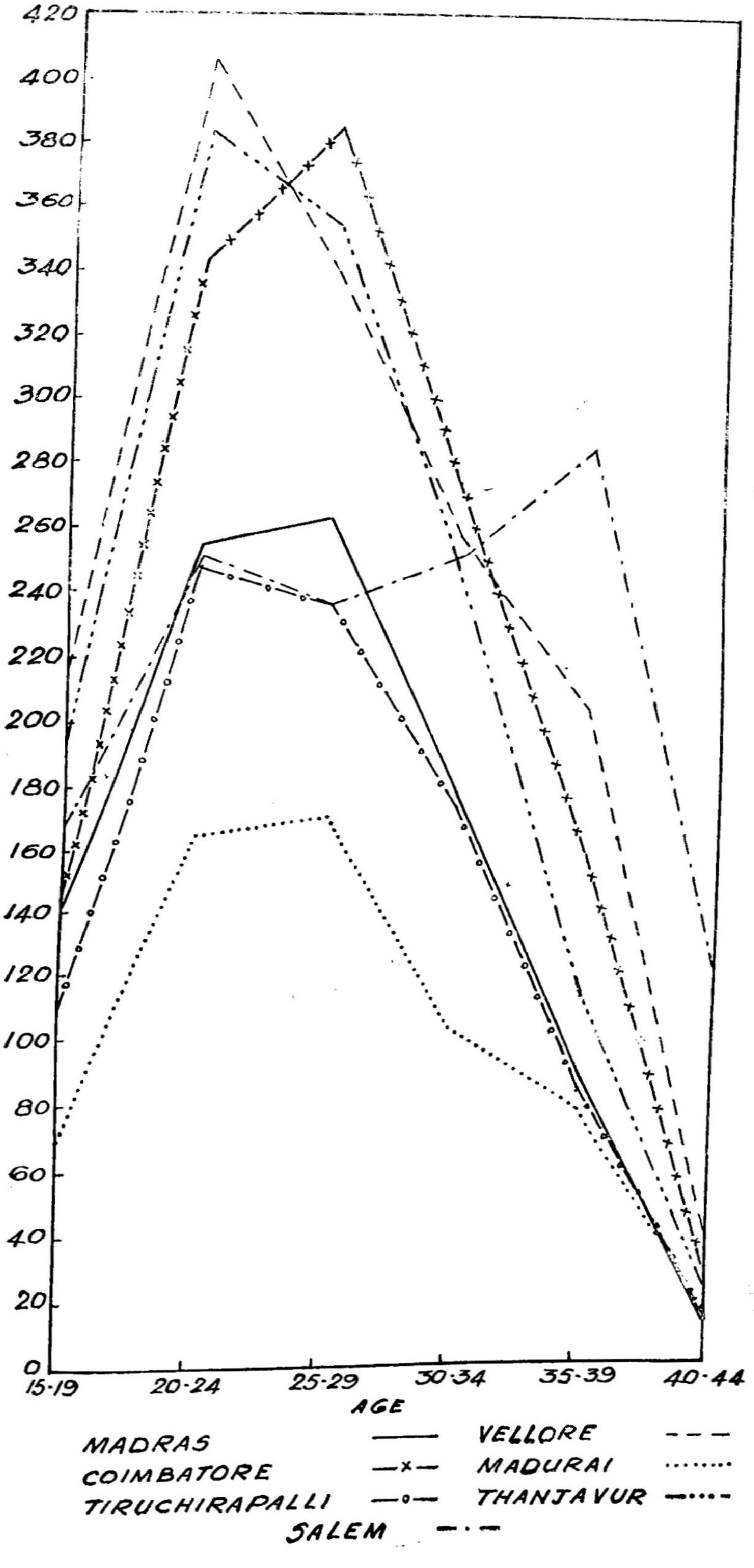
TABLE 3-6

Fertility Rate per 1,000 married women in selected towns, 1961

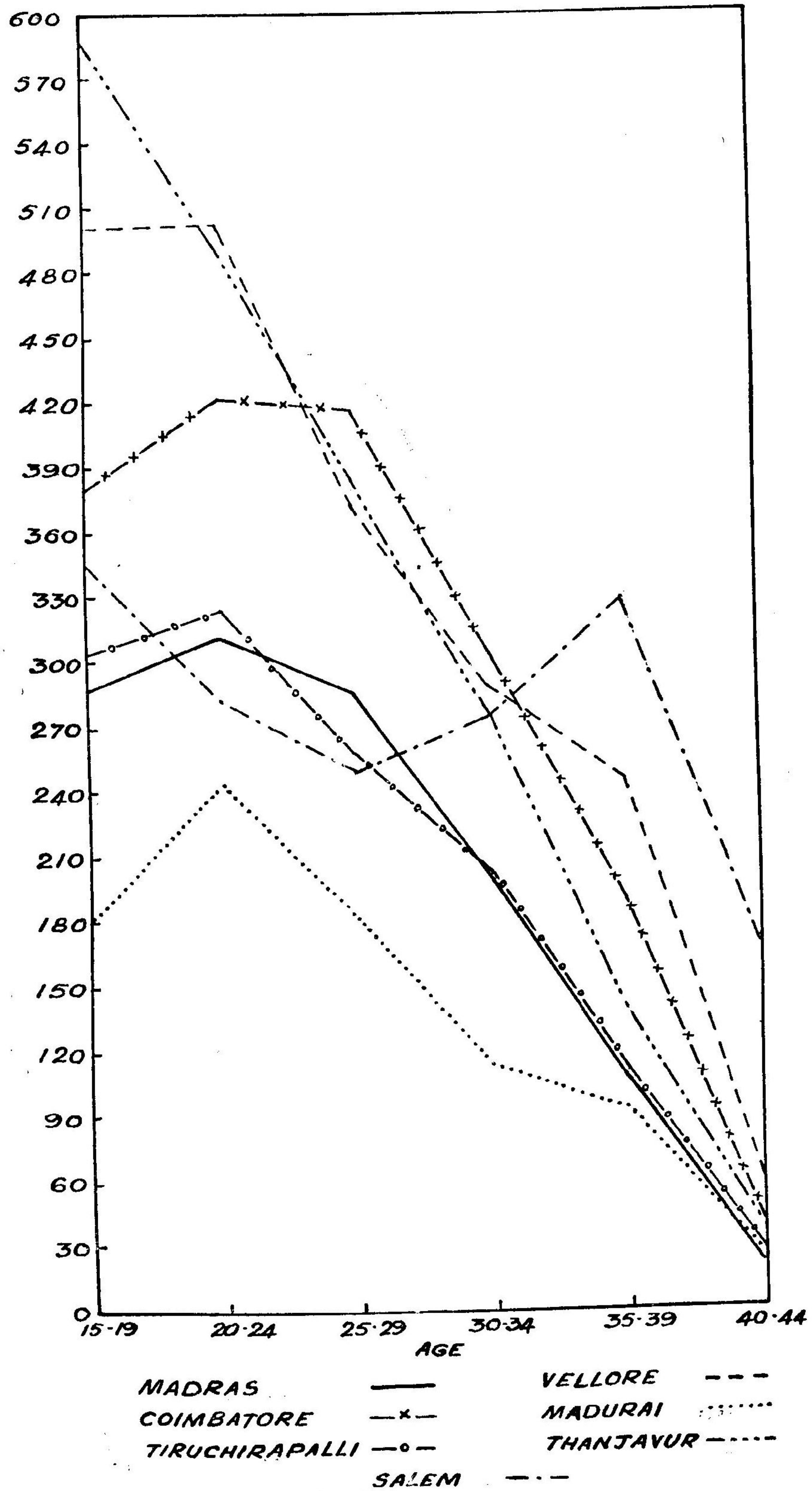
Age Group	Madras	Vellore	Salem	Coimbatore	Madurai	Tiruchirapalli	Thanjavur
15-19 ...	287.2	500.9	345.5	379.2	182.0	304.4	586.9
20-24 ...	311.6	501.6	282.7	421.8	245.0	325.7	490.7
25-29 ...	286.6	373.5	250.7	417.2	183.1	258.7	385.0
30-34 ...	198.5	289.5	274.5	304.7	113.8	198.9	277.7
35-39 ...	105.6	245.0	328.4	188.3	92.3	102.3	138.4
40-44 ...	19.8	58.7	166.4	39.0	23.2	23.5	34.6
45 + ...	1.0	3.5	0.5	2.1	1.3	0.7	3.9
All ages.	201.8	302.4	232.1	282.8	130.8	194.2	278.9

The conclusions drawn from the earlier table are reflected in this table also. Fertility rate of married women starts from a low level in 15-19, reaches its peak in 20-24 and then tapers off to a low level in subsequent age groups. In the peak age group 20-24, the rate ranges from 245 in the case of Madurai to 491

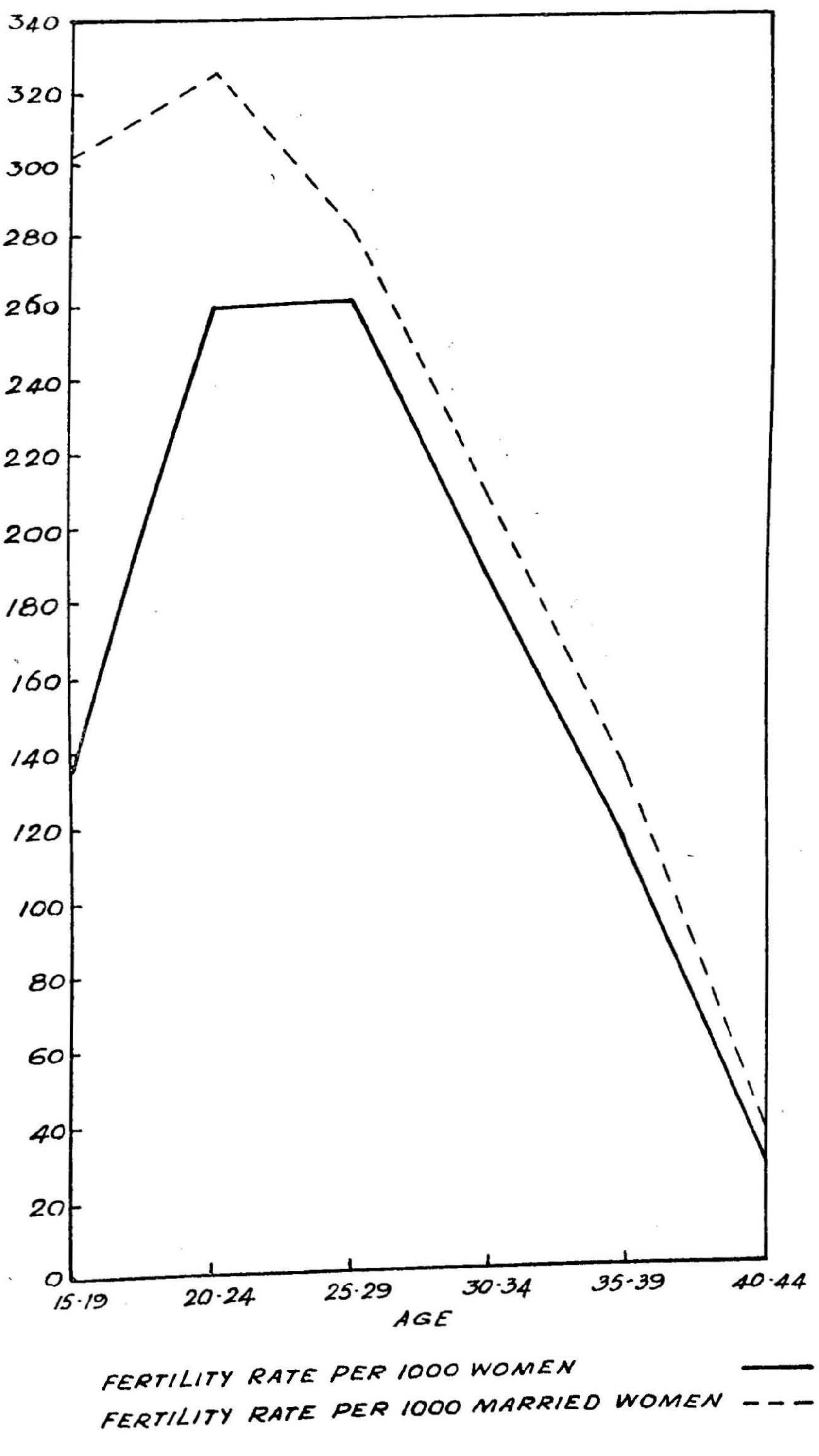
FERTILITY RATE PER 1000 WOMEN
IN RESPECT OF SELECTED CITIES, 1961



FERTILITY RATE PER 1000 MARRIED WOMEN IN RESPECT OF SELECTED CITIES, 1961



FERTILITY RATES FOR ALL WOMEN & MARRIED WOMEN FOR CITIES, 1961



in the case of Thanjavur. A general comparison indicates a low level of fertility in Madurai and a very high level in Thanjavur, Coimbatore and Vellore.

It is relevant to compare here the age specific fertility rates for all women and currently married women.

TABLE 3–7

Fertility Rate and proportion married in selected towns, 1961

Age group		Fertility Rate per 1,000 women	Fertility Rate per 1,000 married women	Proportion married
15–19	...	135.9	303.3	44.8
20–24	...	260.0	325.6	79.9
25–29	...	263.2	285.0	92.3
30–34	...	187.1	207.3	90.2
35–39	...	114.5	135.0	84.8
40–44	...	26.1	36.5	71.6
45+	...	0.5	1.3	37.8
All ages	...	88.2	207.8	42.4

The rate in respect of married women is higher than the corresponding rate for all women (as one should expect) and from the graph it is clear that these two rates run a parallel course from the age group 25-29 onwards. In the earlier age groups *viz.*, 15-19 and 20-24, the rise is more marked in the case of rate for all women than for married women. This is due to a steep increase in the proportion of married women from the age group 15-19 to 20-24, as could be seen from the last column. Between the age groups 20-24 and 25-29, the marital fertility rate has shown a steep decline whereas the rate for all women has remained more or less stable. This is again due to the rise in the proportion married between these two age groups. In the age group 25-29, the highest proportion of married is recorded.

Another important evidence concerning fertility rates available to us is the Fertility Survey. The object of this survey was to collect information on the fertility pattern of women and to study the differentials in fertility according to various characteristics. Approximately 1% of the rural blocks and 2% of the urban blocks were surveyed and the results are available separately for rural and urban areas. The above survey gave a birth rate of 29.2 for rural areas and 29.8 for urban areas. The nuptial fertility rates *viz.*, number of births to 1,000 married women in the age group 13-47 worked out to 150.9 for rural areas and 156.6 for urban areas. The age specific fertility rates are presented below :

TABLE 3–8

Fertility Rate per 1,000 married women. Fertility Survey, 1961

Age group		Rural	Urban
13–17	...	96	110
18–22	...	191	217
23–27	...	219	210
28–32	...	176	176
33–37	...	121	115
38–42	...	61	60
43–47	...	22	15
48+	...	3	2
All ages	...	132	141

These rates require graduation for possible effects of sampling fluctuations and inaccuracies in the reported ages. Further, graduation is necessary for obtaining the fertility rates for the conventional age groups *viz.*, 15-19, 20-24, 25-29, 30-34, 35-39, 40-44 and 45+ to facilitate their application to the data on married women which are available from the 1961 Census for the conventional age groups. The fertility rates per 1,000 married females computed from the fertility survey data for rural and urban areas by different socio-economic classes were plotted on graphs, and a more or less bell shaped curve for both rural and urban areas was noticed.

From the bell shape of the fertility curve, it is felt that a cubic of the form

$$y = a + bx + cx^2 + dx^3$$

will be a suitable formula for representing the fertility rates, where x is the transformed variate $x = \frac{u - o}{c}$ involving u the observed fertility rates, o, a suitable *origin and c the class interval (5). Taking the age group 28-32 with its mid point 30 as the origin*, the transformation becomes $x = 0.2\,u - 6$. The parameters a, b, c and d are estimated by solving the following normal equations :

$$\Sigma y = na + c\Sigma x^2$$

$$\Sigma xy = b\Sigma x^2 + d\Sigma x^4$$

$$\Sigma x^2y = a\Sigma x^2 + c\Sigma x^4$$

$$\Sigma x^3y = b\Sigma x^4 + d\Sigma x^6$$

The following cubic equations were obtained.

Rural. $y = 180.5714 - 50.6582x - 13.5000x^2 + 4.2778\ x^3$.

Urban. $y = 179.1904 - 55.3848x - 12.5476x^2 + 4.3611\ x^3$.

These cubics are good fits* and the fertility rates for the conventional age groups were derived. The rates are presented below :

TABLE 3-9

Fertility Rate per 1,000 married women after graduation

Age group		Rural	Urban
15–19	...	82	100
20–24	...	209	218
25–29	...	205	207
30–34	...	158	155
35–39	...	95	89
40–44	...	40	34
45–49	...	20	17

The age-specific marital fertility rates obtained above can be used for deriving the birth rate and General Fertility Rate for rural and urban areas. The number of married women in rural, urban and total areas in the State in 1961 are given below :

TABLE 3-10

Number of married women in rural and urban areas

Age group		Rural	Urban	Total
15–19	...	446,222	165,480	611,702
20–24	...	982,644	361,051	1,343,695
25–29	...	1,026,763	389,173	1,415,936
30–34	...	786,614	289,460	1,076,074
35–39	...	678,978	230,519	909,497
40–44	...	486,979	159,989	646,968
45–49	...	376,347	111,359	487,706
Total	...	4,784,547	1,707,031	6,491,578

From the discussions in the earlier sections, it is evident that

$$BR = \frac{f_x^m \ F_x^m}{P}$$

$$GMFR = \frac{f_x^m \ F_x^m}{F_{15-49}^m}$$

which can be computed from the age-specific marital fertility rates and the number of married women in rural and urban areas. The birth rates for rural and urban areas worked out by this method are 27.06 and 27.64 respectively. The birth rate arrived at by the Reverse Survival method is 35 per 1,000, and if we assume that there is no rural-urban differential in the birth rate this will amount to an undercount of the order of 13% in the Fertility Survey. In other words, a Correction Factor (CF) for the fertility measures based on the Fertility Survey may be evolved thus :

$$CF = \frac{\text{Birth Rate by Reverse Survival Method}}{\text{Birth Rate from Fertility Survey Data.}}$$

The value of the Correction Factor is 1.29629. The General Marital Fertility Rate for rural and urban areas are obtained by applying the fertility schedules to the respective married females and they work out to 0.139 for rural and 0.145 for urban areas.

Gross and net reproduction rates

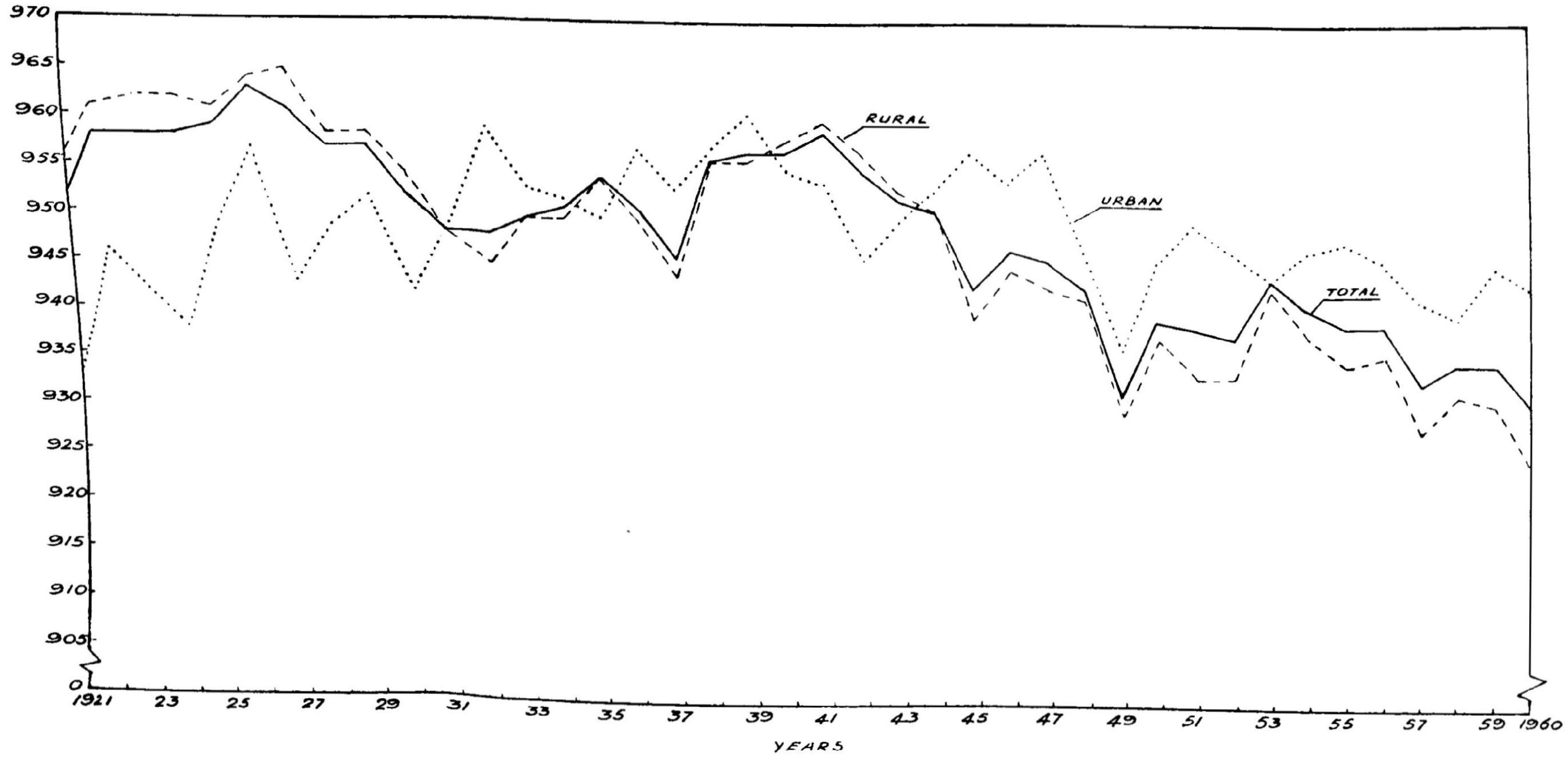
The birth rate in a given year is only a short term measure of the flow of births and gives no indication of the long term effects of contemporary variations in fertility. It is necessary to find out whether or not the current level of fertility, if maintained, is such that in the long run the population will increase or decrease in size and whether there is going to be a change in the age structure of the population.

The natural increase or the balance of births over deaths gives only a picture of the population change (excluding migration) in one year and does not indicate any trend. In any specified year the total deaths depend upon the current age structure of the population, which though influenced by past trends in fertility is affected little by current changes in fertility. The two components of natural increase, *viz.* births and deaths are quite unrelated to each other and hence their balance does not give any indication of the long term growth of the population. It is this problem which has given rise to the concept of population maintenance or replacement.

With the age specific fertility rates computed here, we may consider whether if these rates are maintained

* The goodness of fit was tested by applying the Chi-square test for the observed and expected values.

SEX RATIO AT BIRTH (FEMALES PER 1000 MALES) IN TOTAL, RURAL AND URBAN, 1921 TO 1960



the mothers will produce sufficient girls during their reproductive period (which may be taken as 15 to 49) to replace themselves before they reach menopause. If mortality is ignored we may add all the age specific female fertility rates to obtain the expected number of girls produced by women in their reproductive span. This is known as Gross Reproduction Rate (GRR). Assuming that the mean fertility rates can be applied at individual years of age, the sum of the age specific fertility rates for individual ages will be 5 times those for 5 year age groups.

In practice, an alternative method has been conventionally followed for computing GRR on the basis of the assumption that the ratio of female births to total births is not related to the age of the mother. While calculating the age specific fertility rates, we have taken births of both sexes. These specific fertility rates may be multiplied by the overall ratio of female births to all births over the entire span of reproductive period and the product would yield the reproduction rates for the different age groups. The Total Fertility Rate, multiplied by the overall sex ratio of births therefore gives the GRR. If p_f is the proportion of female births to total births then $GRR = TFR \times p_f$

$$= 5\, p_f \Sigma f_x$$

The sex ratio among births registered in the State during 1951–60 is found to be 1,067 males per 1,000 females. The proportion of female births to total births in 1951–60 works out as 0.4838 and this figure has been adopted here for the computation of the reproduction rates.

The defect of the GRR is that it fails to account for the mortality of infants before they themselves reach the same age as that of the parents they are supposed to replace, and of mortality among parents themselves before the end of the child bearing period. In order to make allowance for the mortality of infants we have to apply to the estimated births in each age group, survival ratios from birth to the present age of the parent. The Net Reproduction Rate (NRR) is therefore given by

$$NRR = 5\, p_f \Sigma f_x\, {}_xs_0$$

where ${}_xs_0$ is the chance of survival from birth to the age x according to currently applicable life tables for females. The computation of the Gross and Net Reproduction Rates for Madras State is indicated in Table 3-11. If N.R.R. is greater than unity, the population is considered as more than reproducing itself. Reading the formula forward, it measures the extent to which mothers produce female infants who survive to replace them ; in reading the formula backwards, it measures the extent to which a generation of female children survive to reproduce themselves as they pass through the child bearing age group.[1]

The chance for survival from birth to a particular age can be obtained from a life table for females for Madras State. Unfortunately no official life tables are available for the Madras State and the life tables prepared in the past by the Census actuaries relate to the South Zone covering approximately Madras, Kerala, Andhra and Mysore States. Further, the last two decades have witnessed some decline in the death rate. Hence, the life table prepared by the Census actuary for the 1951 Census will be of only limited applicability under the changed circumstances. For obtaining a correct picture of the G.R.R. and N.R.R for the State, a new life table has to be prepared for the State, taking into account all the latest available data on age, mortality and migration. In the absence of life tables computed from the 1961 Census data, resort has been made to the projected survival ratio for the Madras State for 1962–63.[2] It is of academic interest to compare these rates with those obtained by using the 1951 Census actuary's life table.

The fertility rates computed in the earlier section relate to married women only. These rates should be multiplied by the proportion of married women in different age groups to yield the overall fertility rates for all women in each age group. Taking 15 and 49 as the lower and upper limits of the reproductive span of women, the GRR works out as 1.625 for rural and 1.610 for urban areas. If we account for the undercount of births in the fertility survey, the GRR becomes 2.1065 and 2.0870 for rural and urban areas respectively. The net reproduction rate based on the 1951 life table works out as 0.9520 for rural and 0.94665 for urban areas and the corresponding adjusted figures are 1.2341 and 1.2271. Using the projected survival ratios for 1962–63 the rural and urban net reproduction rates are 1.56430 and 1.55045 and the corresponding corrected figures are 2.0278 for rural areas and 2.0098 for urban areas. Incidentally, it appears that the reduction in mortality between 1946 and 1962–63 could contribute to a 64% increase in NRR, assuming that all other conditions remain same.

[1] Benjamin, Elements of Vital Statistics, London, 1959, page 68.

[2] Vaidyanathan, K. E., Population Projections for Madras State, 1961–81 (Mimeographed).

TABLE 3-11

Computation of Gross and Net Reproduction Rates for Madras State

Age group	No. of live-births per 1,000 married women	Propor-tion of married women	No. of live-births per 1,000 women	No. of female live-births per 1,000 women Col. 4 × .4838	Survival Rates: Based on 1951 Census Life Tables	Survival Rates: Based on pro-jections 1961-66	Col. 5 × Col. 6	Col. 5 × Col. 7
1	2	3	4	5	6	7	8	9
			RURAL					
15–19 ...	82	0.4385	36	17	0.6508	0.9734	11.06	16.55
20–24 ...	209	0.8779	183	89	0.6306	0.9680	56.12	86.15
25–29 ...	205	0.9299	191	92	0.6015	0.9642	55.34	88.71
30–34 ...	158	0.8903	141	68	0.5638	0.9610	38.34	65.35
35–39 ...	95	0.8387	80	39	0.5209	0.9560	20.32	37.28
40–44 ...	40	0.7281	29	14	0.4752	0.9465	6.65	13.25
45–49 ...	20	0.6445	13	6	0.4283	0.9291	2.57	5.57
				325			190.40	312.86
				GRR	1.625	NRR	0.952	1.564
				Corrected GRR	2.107	Corrected NRR	1.234	2.028
			URBAN					
15–19 ...	100	0.4169	42	20	0.6508	0.9734	13.02	19.47
20–24 ...	218	0.8336	182	88	0.6306	0.9680	55.49	85.18
25–29 ...	207	0.9282	192	93	0.6015	0.9642	55.94	89.67
30–34 ...	155	0.8988	139	67	0.5638	0.9610	37.77	64.39
35–39 ...	89	0.8485	76	37	0.5209	0.9560	19.27	35.37
40–44 ...	34	0.7202	24	12	0.4752	0.9465	5.70	11.36
45–49 ...	17	0.6272	11	5	0.4283	0.9291	2.14	4.65
				322			189.33	310.09
				GRR	1.610	NRR	0.947	1.550
				Corrected GRR	2.087	Corrected NRR	1.227	2.010

The gross reproduction rate is based on the assumptions that out of 1,000 female children born at a given time, all will live through the child bearing period (say up to 49 years) and, that the age specific fertility rates prevailing at the date for which the calculation is made will continue throughout the child bearing life of the group of women under consideration. If the number of female babies born per 1,000 women is found to be 1,500, then the gross reproduction rate is written as 1.50 per woman. What such a rate tells us is that of 1,000 girls born at a given time all live through the child bearing period and if at each age interval they bear

children at the age specific rates prevailing in a given year or period, *e.g.* in 1961, they would have borne one half more daughters than were needed to replace themselves. If, on the other hand, the rate turned out to be .950, then they would have borne only 95% of the number of daughters needed to replace themselves. This is simply expressing total fertility in terms of daughters. The rate then shows the rate of increase or decrease in a generation under the assumption made.

The Net Reproduction Rate unlike the gross, makes allowance for the fact that there will be deaths in any group of females between the time they are born and the time at which they complete their reproductive life. The extent to which taking account of deaths reduces the net reproduction rate below the gross reproduction rate depends on the proportion of women dying between birth and menopause and on the distribution of deaths by age. If infant and child mortalities are very high, as for instance in India, comparatively few (perhaps only 60%) of the girls born reach the reproductive age, and another 22 to 25% may die during the age period 15 to 49. In the United States and a number of Western countries where mortality is low, about 95% of the girls born live to fifteen years of age and about 90% live through the child bearing period. The Demographic year book of the United Nations 1949–50 gives the gross reproduction rate of the United States in 1948 as 1.542 and the net as 1.462. Among the Muslims in Palestine (1940) the rates were 3.81 and 2.17 respectively. In the United States, the net reproduction rate was only about 5% below the gross, while among the Muslims in Palestine the net was over 43% lower than the gross. Obviously the net reproduction rate is more realistic than the gross if we would measure the probable increase of population in a generation under the assumed conditions, but the gross is the better measure of fertility since it tells us that among the Arabs in Palestine the number of girls born per woman averaged 3.81 and the number of boys born averaged 4.02 (3.81×1.055) or a total of 7.83 children per woman. For Madras the corresponding figure is 4.10 children per woman.

An important assumption in the above computations is that the age specific fertility rates prevailing at a given time apply to the entire reproductive life of the women studied and, for the net reproduction rate, the average age specific mortality rates of the same period also remain constant throughout life. But since the age-specific fertility rates may fluctuate rather widely from year to year for a variety of reasons such as a change in the age at marriage and a change in the spacing of births as well as a change in the average number of births per woman, these reproduction rates may fluctuate as much as the crude birth rates. Hence they do not give an accurate measure of changes in the size of the average completed family or of changes in trends of growth. In the long run the factors that determine whether a population will increase or decrease, and the rate at which such increase or decrease will occur are (1) the changes in the proportion of women in a population having children, and (2) the changes in the average number of their children. Thus all the above measures of current natality are more or less defective as measures of change either in trend of growth or in the size of the completed family, chiefly because they fail to take into account changes in the composition of the population and also because they assume that current age-specific fertility rates apply to the entire reproductive period of the women under study. Consequently, the changes in fertility rates and in the average number of children shown by these rates must not be accepted as measures of change in the average size of the completed family.

Standardised Birth Rate

One of the early refinements on the crude birth rate used to secure a better measure for the comparisons of natality between groups is the standardised birth rate. A standardised birth rate is what the birth rate for a group of women would be if these women had the same age distribution as those in some standard population. It is computed by taking the age specific birth rates for women in a particular population and multiplying each of the rates by the number of women in the standard population in the corresponding age category and then expressing the estimated births as a proportion of the population.

The population of India has been adopted as the standard population and the standardised birth rate has been worked out. The standardised birth rate therefore expresses the birth rate if the fertility schedule of Madras is applied to the population of India. Incidentally an attempt has been made to compare the birth rates obtained from smoothed and unsmoothed data. There is considerable inaccuracy in the reporting of age in the Census ; this is also operative in the vital statistics returns relating to age of mother. Methods have been evolved to graduate census age data, and even this could give only an approximation to the real situation. The distribution of children born to mothers in each age group cannot be adjusted due to lack of knowledge governing such distribution. On the other hand, the age specific fertility rates obtained from unsmoothed data could be adjusted by using the cubic equation $Y = 235.593 - 80.605x - 24.386x^2 + 9.954x^3$

where x is a transformed variate of the age groups.+ The observed and expected values are given below :—

TABLE 3-12

Fertility rate based on data for selected towns

Age Group		Observed value	Graduated value
15—19	...	135.9	129.2
20—24	...	260.0	268.0
25—29	...	263.2	268.6
30—34	...	187.1	190.4
35—39	...	114.5	93.4
40—44	...	26.1	37.2

The smoothed and unsmoothed age distribution for all India is given below :—

TABLE 3-13

Female population by age groups, all India and Madras

Age group	Unsmoothed		Smoothed†	
	India	Madras	India	Madras
15—19 ...	17,255,857	1,414,588	20,847,700	1,720,500
20—24 ...	19,105,755	1,552,404	18,469,300	1,576,500
25—29 ...	18,024,631	1,523,519	16,683,500	1,415,300
30—34 ...	14,832,236	1,205,554	14,593,100	1,241,300
35—39 ...	11,841,585	1,081,289	12,115,200	1,046,500
40—44 ...	10,754,185	891,002	10,067,500	882,300
45+ ...	33,133,819	2,823,547	31,234,100	2,633,800
Total ...	124,948,068	10,491,903	124,010,400	10,516,200

Now there are 4 alternative possibilities of working out birth rate for India and Madras State, their basis being :

A : Graduated Fertility rates and age data.

B : Graduated Fertility rates and ungraduated age data.

C : Ungraduated Fertility rates and graduated age data.

D : Both ungraduated.

The results obtained from these 4 possibilities are as follows :

		Standardised Birth rate‡	Birth rate
A	...	37.4	41.3
B	...	37.7	40.7
C	...	37.4	41.3
D	...	37.6	40.7

A comparison of the 4 results above shows that much variation does not arise due to adoption of graduated and ungraduated data. It is seen that Madras birth rate is higher than the standardised Birth Rate. This clearly shows that the age structure of Madras population favours a higher birth rate than that of all India, assuming that the fertility schedule for the selected towns holds good. Actually the birth rate for Madras State is estimated to be of the order of 3.5 which shows that there are factors other than age structure which tend to depress fertility. It has been pointed out that age at marriage, incidence of widowhood, and operation of contraception and sex ratio have an adverse effect on Madras fertility.* This will be discussed in a later chapter dealing with population growth.

The Standardised Birth Rates for each district could not be worked out due to lack of data on age specific fertility rates for each district. Even the Standardised Birth Rate discussed here is based on the fertility schedule for a few selected towns and cannot be accepted as valid for the State as a whole. As pointed out earlier the birth rate for the towns discussed here is generally higher than the birth rate for the State. This is largely due to births occurring to persons who are not residents of these towns, but who have migrated to these towns to avail of the medical facilities available in these urban centres. This aspect will be examined in detail in the next chapter while discussing Rural-Urban differentials in fertility.

+ The Chi-square test at 5% level indicates a good fit.

† Census of India, Paper No. 2 of 1962, Age Tables, pp. 35 & 39.

‡ Using the age distribution of India.

*Vaidyanathan, K. E., and Gnanasekaran, K. S. "An Empirical Analysis of the factors contributing to a lower growth rate in Madras State," *Indian Economic Journal*, 1961.

Family Size

Data regarding family size are available from the Fertility Survey conducted in 1961. The figures available from the survey should be regarded only as a lower limit to the actual family size in view of the possible under enumeration of births in the enquiry. However, the data are of value since otherwise little information is available regarding family size in relation to duration of marriage and age at marriage.

TABLE 3–14

Average number of children born to women of incomplete fertility

Duration of marriage years	Age at Marriage: Below 18		18—22		23 and above	
	Rural	Urban	Rural	Urban	Rural	Urban
1—4 ...	0.64	0.71	0.63	0.65	0.48	0.63
5—9 ...	1.84	1.93	1.72	1.69	1.51	1.44
10—14 ...	2.90	3.11	2.59	2.64	2.15	2.28
15—29 ...	3.84	4.11	3.40	3.42	2.90	2.86
30+ ...	3.99	4.02	3.39	3.33	3.17	3.14

Reading this table vertically we notice that there is an increase in the average size of family with duration and reading the table horizontally we find a decrease in average family size with age at marriage. However, the data relate to women some of whom are still in their reproductive span and a higher proportion of them for instance in duration 1–4, could lead to a smaller family size than those of duration 5–9. Likewise, those in 23 and above age group should in fact have fewer children than those who married before 18, since the latter should have experienced a longer duration of married life. Thus, the above data on incomplete fertility cannot throw light on the trends in fertility of women.

A more useful mode of analysis will be to take women of completed fertility, *i.e.*, those who are already past their reproductive span and study their family size according to duration of marriage. In the fertility survey, the women in the age group 43 and above have been treated as women of completed fertility.

The following data show the decline in the number of children ever born to women at ages 43 and over in Madras (rural and urban areas) as revealed by the Fertility Survey conducted in 1961.

TABLE 3–15

Average number of children born to women of completed fertility

Age at Marriage		Rural	Urban
Below 18	...	4.0	4.0
18—22	...	3.4	3.3
23 and above	...	3.0	2.9

The important point here is that in both rural and urban areas, the number of children born in completed families from the earliest group of women to the most recent group, shows a small decline.

A similar story is told by the data on completed fertility built up from the questionnaires of the Family Planning Survey carried out in 1963–64. The figures are as follows :—

TABLE 3–16

Average number of children born to women of completed fertility (43 and above)

Married			Average No. of Children
1933–1948	...	...	4.48
Before 1933	...	...	5.47

Somewhat similar data in other countries reveal more or less the same picture. A special study of fertility in England and Wales carried out in connection with the 1911 Census showed the number of children ever born to wives with completed families (age over 45 at Census) who were married at different dates. Although the data cannot be directly compared with

the data for Madras State, there cannot be any doubt that the trend in the size of the completed family in England and Wales was downward from the decade preceding 1880 upto 1946.

TABLE 3-17

Average size of completed family, Great Britain 1946 & 1911

Married women, Great Britain, * 1946			Wives over 45, England and Wales ** 1911		
Date of Marriage	Duration of marriage years	Average number of children born	Date of Marriage	Duration of marriage years	Average number of children born
1925-1929	17—21	2.19	1881-1886	25—30	5.25
1920-1924	22—26	2.38	1871-1881	30—40	6.05
1915-1919	27—31	2.53	1861-1871	40—50	6.79
1910-1914	32—36	2.90	1851-1861	50—60	7.28
1900-1909	37—46	3.37	Before 1851	60 & over	7.61

It will not be possible to present comparable data for other countries, but there is little doubt that a similar decline in the average number of children born per family has taken place in practically all countries of European culture, although the time when the decline started and its extent and rapidity have varied considerably from country to country.

There has been much interest in recent years in the fertility of a population which would be adequate to replace it or add to it at a given rate. In the South Zone for which life tables have been prepared by the Census Actuary for 1961, about 71.5% of the females born could expect to live to fifteen years of age and 47.0% would live to 45 years of age. Thus the loss during the child bearing age will be about 24.5% and from birth to menopause about 53.0%. Another 13% of those who enter the child bearing period do not marry, according to the 1961 Census data and since the illegitimate birth rate is likely to be negligible they do not contribute to the total birth rate. When allowance is made for women aged fifteen and over who die before they bear a child and for those who do not marry, it is probable that about 25% of the women who enter the child bearing period do not bear children for these reasons. For purposes of illustration, let us assume that 25% of the 71,549 women out of the 100,000 born who reach 15 years of age (1951-61) do not have children either because they do not marry or because they die before they have borne children. Thus about 17,900 must be deducted from the number who enter the child bearing age because they are very unlikely to become mothers. Hence there are about 53,650 out of each 100,000 females born who marry and who live long enough to have families of average size. This is only an approximate calculation.

If we assume that 7% of the married women are infecund, then of the original 100,000 female babies only 49,900 married women remain to provide for the replacement of their generation *i.e.*, as the mothers of the 100,000 daughters needed to replace the original cohort of 100,000 female babies. To do this each fecund married woman must, therefore, have 2 daughters. Since as a rule 105 boys are born to each 100 girls, the total number of children each fecund married woman would need to bear to maintain the population under the conditions defined above would be about 4.1. These calculations are not exact. Moreover, for any future period death rates and marital status and the proportions of infertile marriages may change. However, this indicates the approximate average size of the family needed by each fertile couple to maintain a population of a given size under conditions similar to those that prevail today.

Replacement Index

The Replacement Index is sometimes used as a substitute for the Net Reproduction Rate. Given an age distribution of actual female population and a female life table for the same period, the replacement index has, as its numerator the ratio of children under age 5 years to females at the reproductive ages in the actual population and as its denominator, the corresponding ratio in the stationary or life table population. From the 1961 Census data the ratio of children under 5 years to 1,000 women aged 15 to 44 is found to be 601. In the life table population assuming the life tables for the Southern Zone prepared by the Census actuary for the decade 1951-1961, the ratio is found to be 444. The replacement index for Madras is therefore 1.36.

* Royal Commission on Population Report, page 25, HMSO, London, 1949.

** Great Britain, Census Office, Fertility of Marriage, Part 2, Page XCVII, HMSO, London, 1923.

Plural births

Data on the extent of plural births are available from the Fertility Survey of 1961. The figures are given below :

TABLE 3–18

Contribution of multiple births, current fertility

Age of mothers		Total births	Births arising from multiple births	Plural births per 1,000 confinements
13—17	...	188	—	—
18—22	...	2,734	18	6.6
23—27	...	3,266	32	9.8
28—32	...	2,435	32	13.1
33—37	...	1,140	14	12.3
38—42	...	517	4	7.7
43—47	...	104	...	...
48+	...	24	...	...
All ages	...	10,408	100	9.6

It appears that approximately one out of 100 women confinements end in multiple births. The ratio of multiple births to total births progressively increases with age and it is highest (13 per 1,000) in the age group 28–32 and thereafter it tapers off.

Average number of children by attained age

The fertility survey data are useful for studying the average number of children by attained age of women.

TABLE 3–19

Average number of children by age of mother

Age of women		Rural		Urban	
		No. of women	Average No. of Children born	No. of women	Average No. of children born
13—17	...	1,175	0.2	702	0.3
18—22	...	8,084	0.9	5,446	1.0
23—27	...	8,867	2.0	6,263	2.1
28—32	...	7,974	3.0	5,747	3.2
33—37	...	5,782	3.6	3,722	3.8
38—42	...	5,234	3.8	3,252	4.0
43—47	...	3,378	3.9	1,989	3.9
48 and above	...	5,692	3.7	3,056	3.7
Total	...	46,186	2.7	30,177	2.8

The average number of children born per woman of incomplete fertility works out to be less than 3, but this is exceeded in the age groups 28 and above. This is due to the fact that in the earlier age groups, women are still in their fertile ages and some of whom will be having little marital experience. With the rise in age, there is also a corresponding rise in the average number of children born, which explains the close relation between the two. The pattern is identical in both rural and urban areas.

Birth order and fertility

One of the factors determining fertility is the birth order. The following table shows the average number of children contributed by each birth order to the average size of a family of completed fertility.

TABLE 3–20

Average number of children of each birth order for mothers of completed fertility

Order of birth		Rural	Urban
1	...	.93	.92
2	...	.80	.79
3	...	.66	.65
4	...	.50	.50
5	...	.35	.35
6	...	.23	.24
7	...	.13	.15
8	...	.07	.09
9	...	.04	.05
10+	...	.02	.02
Average family size	...	3.73	3.76

It is interesting to note that the births of order 4 and above have contributed to 1.34 children in rural and 1.40 children in urban areas. These when compared to the average family size of rural and urban areas amount to 36% and 37% respectively. In the 1951 Census report for All India, Shri R. A. Gopalaswami has advocated a reduction in the Improvident Maternity (proportion of births of 4th and higher orders) by propagating family planning. Data on earlier years are not available and therefore it is not possible to find if there has been any reduction in this ratio since Shri R. A. Gopalaswami wrote his report. However it could be safely concluded that even the existing level of 36% is of serious concern to us and one should expect that when our family planning schemes bear fruit, this will be considerably reduced.

Another way of looking at this problem is to examine what is the most preferred size. This will be clear from the proportion of families reporting different sizes.

TABLE 3-21

Percentage of families of different sizes for mothers of completed fertility

No. of Children		Percentage of families Rural	Urban
0	...	6.6	8.1
1	...	13.3	12.9
2	...	13.7	13.9
3	...	16.2	15.0
4	...	15.0	14.7
5	...	12.4	11.7
6	...	9.4	8.7
7	...	6.3	6.3
8	...	3.5	4.1
9	...	2.0	2.4
10+	...	1.6	2.2
Total	...	100.0	100.0

It is noticed that the highest proportion of women have reported 3 children in both rural and urban areas—16.2% in rural and 15.0% in urban areas. The next two positions are occupied by 4 and 2 children respectively.

A very useful measure of the changes in fertility with the order of birth is the Parity Progression Ratio which is expressed as the proportion of women who got n+1 th child, n children having been born and its counterpart, Sterility Ratio which expresses the proportion of women who ceased reproduction after getting 'n' th child among women of completed fertility. The following table gives the Parity Progression Ratio and Sterility Ratio for rural and urban areas computed from the Fertility Survey data.

TABLE 3-22

Parity Progression Ratio and Sterility Ratio for women of completed fertility

Parity		Parity Progression Ratio		Sterility Ratio	
		Rural	Urban	Rural	Urban
0	...	93.4	91.9	6.6	8.1
1	...	85.7	86.0	14.3	14.0
2	...	82.9	82.4	17.1	17.6
3	...	75.6	76.9	24.4	23.1
4	...	70.2	70.7	29.8	29.3
5	...	64.7	67.0	35.3	33.0
6	...	58.9	63.1	41.1	36.9
7	...	53.1	58.1	46.9	41.9
8	...	51.4	53.0	48.6	47.0
9	...	44.1	48.3	55.9	51.7

It is interesting to observe first how the ratios for a given parity compare in size with those of other parities. The 0–1 parity ratio is 93.4 for rural and 91.9 for urban areas, but the ratio is more or less equal between rural and urban areas for parities 1 to 4 and in subsequent parities the urban ratio is higher than the rural ratio. This could indicate a higher frequency of pregnancy in urban areas after the 4th pregnancy is attained. It is worthwhile to examine Parity Progression Ratios according to age at marriage of women computed from the fertility survey data.

TABLE 3-23

Parity Progression Ratio by age at marriage

Parity		Age at marriage Below 18		Age at marriage 18—22		Age at marriage 23 and above	
		Rural	Urban	Rural	Urban	Rural	Urban
0	...	95.4	92.8	90.8	89.7	88.7	86.0
1	...	86.5	87.3	82.6	81.9	79.6	83.2
2	...	84.3	83.8	79.0	78.2	79.0	74.7
3	...	78.0	79.3	73.2	73.2	65.6	65.2
4	...	73.0	73.4	68.7	69.7	60.1	60.0
5	...	66.7	69.3	60.3	61.5	54.7	64.4
6	...	60.0	65.1	62.1	59.8	46.2	55.2
7	...	54.5	60.0	51.2	61.5	70.8	56.3
8	...	50.1	55.2	57.7	50.0	23.5	11.1
9	...	43.8	50.3	49.3	50.0	25.0	0.0

It is noticed that the Progression Ratio for parities 0 to 5 decline with increase in the age at marriage, but in the subsequent parities the tendency is not uniform. For parity 6 in rural areas we find an increase in the age at marriage groups 18–22 followed by a decline in 23 and above, but in the urban areas a steady decline is noticed. For parity 7 in rural areas there is a decline in the age group 18–22 followed by a rise in the 23 and above age group. In the subsequent parities also, we do not find any uniform tendencies. It is difficult to explain these as several factors like sterility of husbands, practice of contraception and deliberate abstinence affect the progression ratios and a further analysis has to wait till more data are available on the subject.

Trend in the birth rate

In spite of the limitations of our registration system they can be used for certain purposes keeping in view their deficiencies. The reported birth rates are presented in Table 3-27 from 1921 onwards. The conclusions that emerge from the table are the same as the one Davis has drawn from similar figures for India. His conclusions are : " First, Indian fertility is high ; the rate with even very defective registration has only since 1941 dropped below 30 and has generally remained above 33 per thousand. Second, the range of variation is not so great or so rapid as that exhibited by urban-industrial nations. Third and most important, there is a slight suggestion of a long run downward trend, although it rests so heavily on the beginning and ending periods that caution should be exercised in giving it emphasis."

The deficiency of the registration system being what it is, recourse has been made to estimates. In the past such estimates have been attempted by statisticians on the basis of Census returns and life table values—independently of the registration statistics. Mr. G. F. Hardy, who was the actuary for the 1911 Census has made estimates of the birth rates for the three decades between 1881 and 1911 and they are presented below :

TABLE 3-24

Hardy's Estimates of Birth Rates

	Estimated by Hardy			Reported
	1881-1891	1891-1901	1901-1911	1901-1911
Bengal ...	52.9	43.9	56.0	37.6
Bombay ...	50.3	43.9	50.8	33.4
Madras ...	51.3	44.8	47.2	30.8
Punjab ...	46.8	47.1	52.9	41.2
United Provinces.	45.1	44.7	47.7	41.4

Source : Kingsley Davis, Population of India & Pakistan pp. 68.

Using, like Hardy, life tables for India, but following a different method, Kingsley Davis has estimated birth rates for India and selected provinces. The figures are given below :

TABLE 3-25

Davis' Estimate of Birth rates by selected Provinces, 1926-1930

Province		Reverse Survival* 1926-30	Successive approximation** 1926-30
British India	...	45.19	41.29
Ajmer-Merwara	...	46.31	...
Baroda	...	44.67	...
Bombay	...	44.46	41.75
Central Provinces & Berar	...	45.83	47.29
Coorg	...	32.93	33.78
Hyderabad	...	50.40	...
Madras	...	41.93	38.71
Mysore	...	40.70	...
Punjab	...	47.11	42.76
Travancore	...	50.84	...
United Provinces	...	46.32	40.66

* These are made by taking the children at each age 0 to 9 in the Census and with the survival rates in the life table, working back to the births that must have occurred to give rise to each cohort. Adding up the births estimated for the ten cohorts, the average annual birth rate is calculated.

** In this method, each single year age group in the Census is followed back on the basis of the deaths registered by age, to the births that must have occurred in order to make the census figures possible. The estimated births are then matched with the actually recorded births to form a notion of the extent of under registration. Assuming that deaths are equally under registered, the number of deaths is inflated and a new estimate of births prepared. The process is repeated a third time.

The following conclusions have been drawn by Kingsley Davis. "There is some evidence here that after 1921 the birth rate started to decline slightly. This evidence is more impressive when we realise that an important source of error—the under enumeration of children below 10—is likely to be less significant in later than in earlier Censuses. This error would tend to diminish with progressive Censuses in India, thereby pushing up the estimated birth rate in the later decades. That the rate has instead gone down a bit suggests that there has been a real, though perhaps small drop in fertility since 1921. In this matter the estimated birth rates tend to agree with the official ones although the two sets of figures are derived independently. We take it as a fair conclusion, therefore, that the level of the Indian crude birth rate has been slightly lower since 1921."

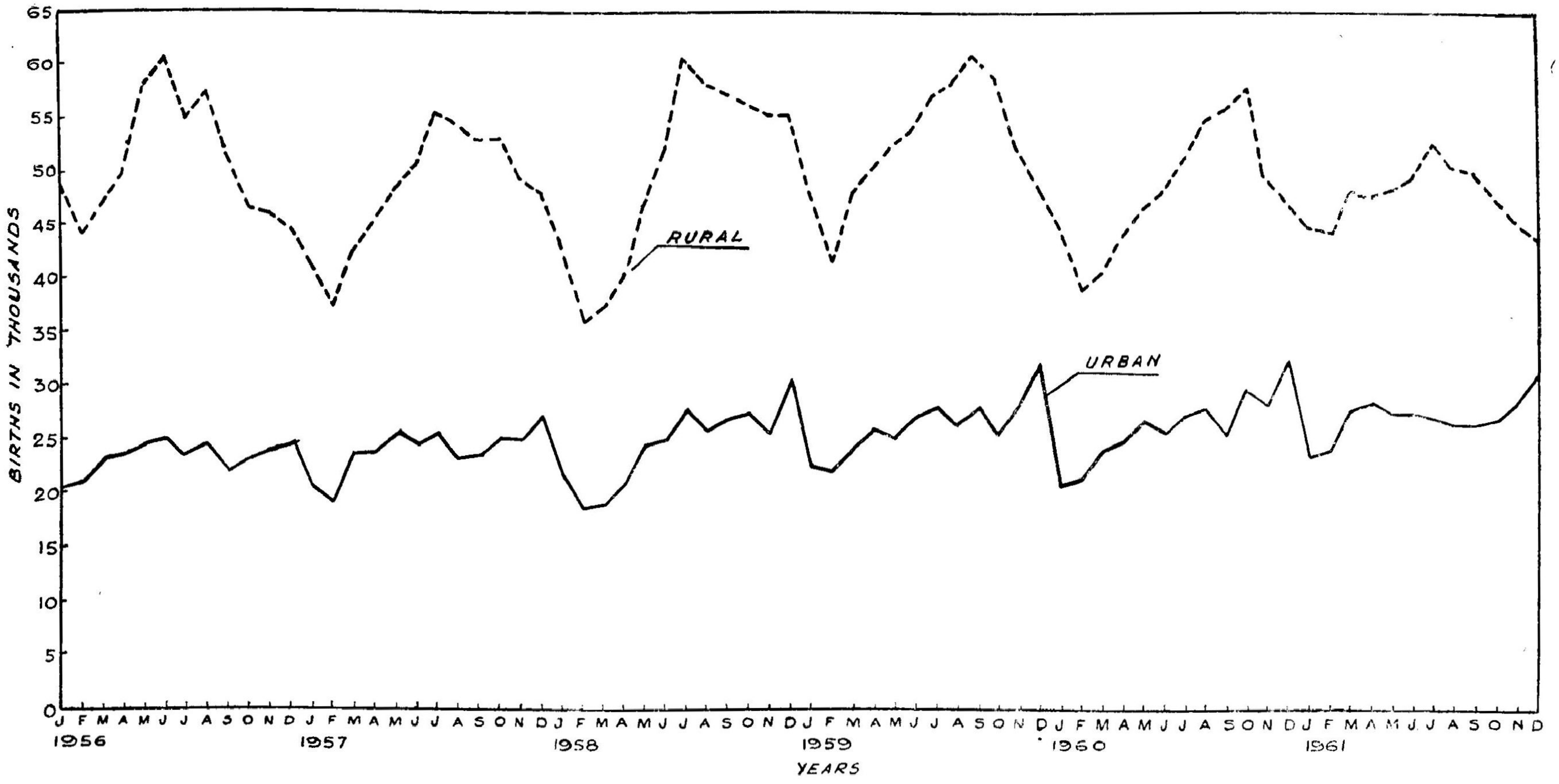
TABLE 3-26

Births in Rural and Urban Areas of Madras State—1956-61.

MONTH-WISE

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
						RURAL							
1956 ...	48,547	44,245	47,190	49,841	57,786	60,647	55,529	57,631	51,517	46,885	45,920	44,408	610,146
1957 ...	41,429	37,198	43,043	45,104	48,361	50,694	55,662	54,768	53,081	53,246	49,878	48,161	580,625
1958 ...	42,655	36,315	37,534	40,497	47,100	51,969	60,628	58,880	57,795	56,521	50,519	50,405	590,818
1959 ...	47,401	41,583	48,034	50,177	52,108	53,951	56,968	58,928	60,988	58,825	52,588	48,927	630,478
1960 ...	45,067	38,967	41,998	44,121	46,810	48,045	51,887	54,947	55,849	57,993	50,051	47,720	583,455
1961 ...	45,312	44,560	48,717	48,182	48,485	49,620	53,456	50,486	49,728	48,014	45,832	44,565	576,957
Total ...	270,411	242,868	266,516	277,922	300,650	314,926	334,130	335,640	328,958	321,484	294,788	284,186	3,572,479
Average No. of Births in each month ...	45,069	40,478	44,419	46,320	50,108	52,488	55,689	55,940	54,826	53,581	49,131	47,364	595,413
Percentage to Total Births ...	7.6	6.8	7.5	7.8	8.4	8.8	9.4	9.3	9.2	9.0	8.2	8.0	...
						URBAN							
1956 ...	20,586	21,093	22,949	23,590	24,567	25,451	23,869	24,614	22,578	23,130	24,023	24,777	281,227
1957 ...	20,564	19,063	23,545	23,461	25,565	24,399	26,043	22,978	23,323	24,923	25,080	27,073	286,017
1958 ...	21,541	18,164	19,198	21,135	24,521	25,133	27,925	26,008	27,157	27,471	25,738	30,252	294,243
1959 ...	22,590	21,945	24,368	25,653	25,160	27,039	28,135	26,749	28,075	25,839	27,995	31,765	315,313
1960 ...	20,950	21,706	23,904	25,090	27,007	26,176	27,288	27,950	25,624	29,739	28,868	32,312	316,614
1961 ...	23,588	24,184	27,874	28,342	27,433	27,306	26,975	26,478	26,437	27,136	28,378	31,061	325,192
Total ...	129,819	126,155	141,838	147,271	154,253	155,504	160,235	154,777	153,194	158,238	160,082	177,240	1,818,606
Average No. of Births in each month ...	21,637	21,026	23,640	24,545	25,709	25,917	26,706	25,796	25,532	26,373	26,680	29,540	303,101
Percentage to Total Births ...	7.1	6.9	7.8	8.1	8.5	8.6	8.8	8.5	8.4	8.7	8.8	9.8	...

MONTHWISE BIRTHS IN RURAL AND URBAN AREAS, 1956 TO 1961



BIRTH RATES IN MADRAS STATE (1921-60)

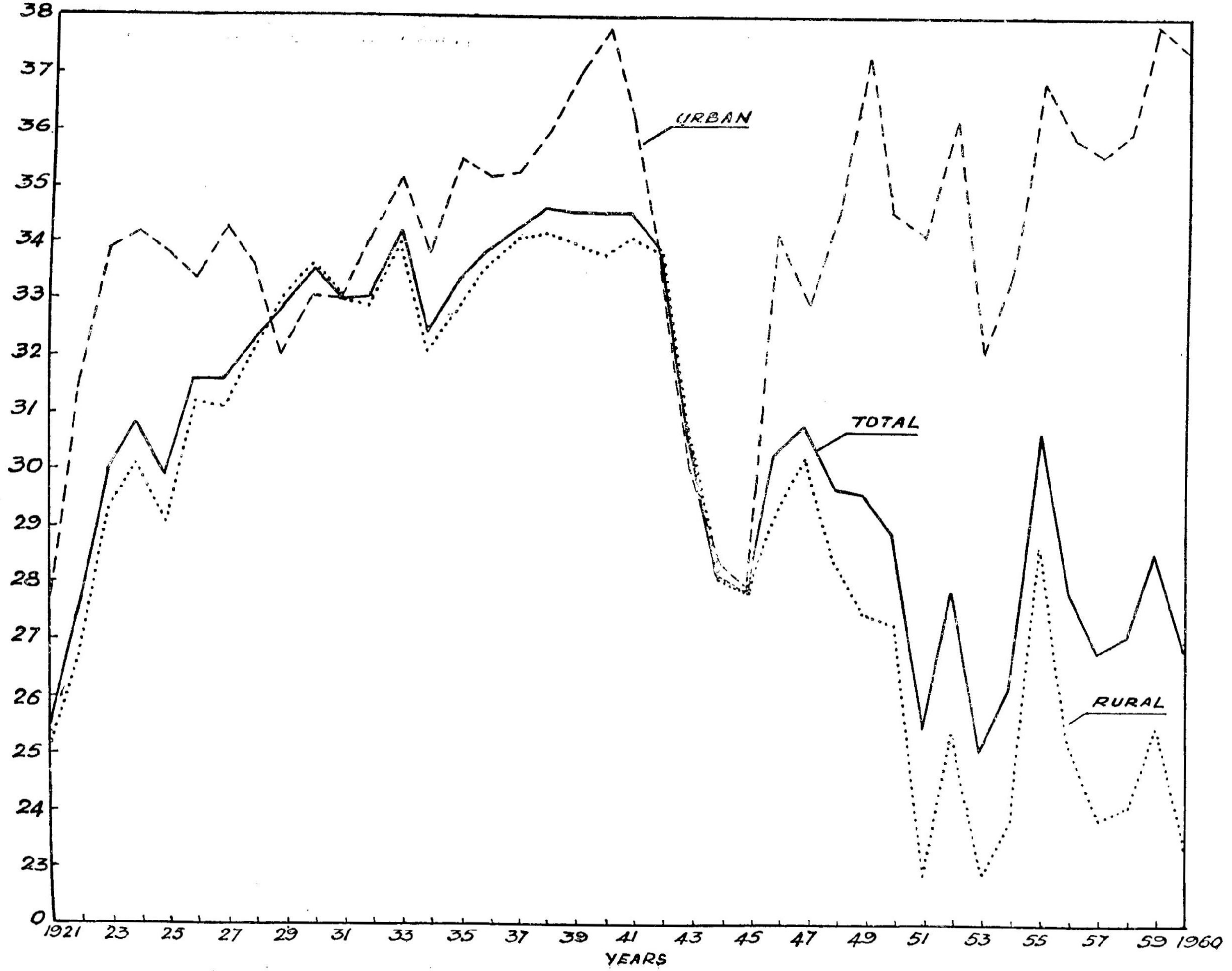


TABLE 3–27

Birth Rates in Madras State, 1921—1960

Year		Total			Rural			Urban		
		Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average
1		2	3	4	5	6	7	8	9	10
1921	...	25.5	...	...	25.1	...	...	27.7	...	...
1922	...	27.5	...	...	26.7	...	...	31.5	...	...
1923	...	30.0	28.7	...	29.3	28.1	...	33.9	32.2	...
1924	...	30.8	...	...	30.1	...	...	34.2	...	...
1925	...	29.9	...	...	29.1	...	...	33.8	...	...
				30.6			30.1			32.8
1926	...	31.6	...	...	31.2	...	...	33.4	...	...
1927	...	31.6	...	...	31.1	...	...	34.3	...	...
1928	...	32.3	32.4	...	32.1	32.2	...	33.6	33.3	...
1929	...	32.9	...	...	33.0	...	...	32.0	...	...
1930	...	33.5	...	...	33.6	...	...	33.1	...	...
1931	...	33.0	...	...	33.0	...	...	33.0	...	—
1932	...	33.1	...	...	32.9	...	...	34.1	...	...
1933	...	34.2	33.2	...	34.0	33.0	...	35.2	34.3	...
1934	...	32.4	...	...	32.1	...	...	33.8	...	...
1935	...	33.3	...	...	32.8	...	...	35.5	...	...
				33.8			33.5			35.3
1936	...	33.9	...	...	33.6	...	...	35.2	...	...
1937	...	34.3	...	...	34.1	...	...	35.3	...	...
1938	...	34.6	34.4	...	34.2	33.9	...	36.0	36.3	...
1939	...	34.5	...	...	34.0	...	...	37.0	...	...
1940	...	34.5	...	...	33.8	...	...	37.8	...	...
1941	...	34.5	...	...	34.1	...	...	36.2	...	...

TABLE 3-27—(*Contd.*)

Birth Rates in Madras State, 1921—1960—(*Contd.*)

Year	Total			Rural			Urban		
	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average
1	2	3	4	5	6	7	8	9	10
1942 ...	33.9	...	...	33.9	...	...	33.6	...	...
1943 ...	30.6	31.0	...	30.7	30.9	...	30.1	31.2	...
1944 ...	28.2	...	...	28.1	...	...	28.3	...	...
1945 ...	27.9	...	...	27.9	...	...	28.0	...	...
			30.4			29.7			33.0
1946 ...	30.3	...	...	29.2	...	...	34.2	...	...
1947 ...	30.8	...	...	30.2	...	...	33.0	...	...
1948 ...	29.7	29.9	...	28.4	28.5	...	34.6	34.7	...
1949 ...	29.6	...	...	27.5	...	...	37.3	...	...
1950 ...	28.9	...	...	27.3	...	...	34.6	...	...
1951 ...	25.5	...	...	22.9	...	...	34.2	...	...
1952 ...	27.9	...	...	25.4	...	...	36.2	...	...
1953 ...	25.1	27.1	...	22.9	24.8	...	32.1	34.6	...
1954 ...	26.2	...	...	23.9	...	...	33.5	...	...
1955 ...	30.7	...	...	28.7	...	...	36.9	...	...
			27.3			24.6			35.6
1956 ...	27.9	...	...	25.3	...	...	35.9	...	...
1957 ...	26.8	...	...	23.9	...	...	35.6	...	...
1958 ...	27.1	27.5	...	24.1	24.4	...	36.0	36.6	...
1959 ...	28.6	...	...	25.5	...	...	37.9	...	...
1960 ...	26.9	...	...	23.4	...	...	37.4	...	...

CHAPTER IV

DIFFERENTIAL FERTILITY

In the previous chapter, we have made a passing reference to the existence of differentials in fertility of different groups and areas. The experience of the western countries has shown that such differentials can be found between different communities within every country, apart from such differences from country to country. Various factors contribute to such differences, the most important being the extent of the practice of abortion, the rigour with which the segregation of the sexes is enforced at certain periods of life, the practice of allocating young women to older men as wives, as well as other practices which affect fertility. It is also possible that there were certain differentials in fertility as between groups and classes within the same society, although positive evidence of this is lacking.

There would be relatively small differentials in fertility as between groups within a given society or between different societies, if it were not for differences in the customs and habits of different groups as regards sexual and marital practices and as regards the extent of abortion. Without such limiting factors practically all women would tend to bear children to the maximum of their physiological capacity. In fact, however, social attitudes which effect a reduction in births below the physiological maximum are so universal that it is almost meaningless to speak of the maximum physiological capacity to reproduce. Further, there are vast differences in the ability to reproduce between couples as measured by their reproduction performance even before voluntary conception control came into existence. According to Warren Thompson there is no evidence to show that fecundity, *i.e.*, the physiological capacity to produce, was any different in one group or society than in another.[1] Until such evidence is available it must be assumed that differentials in fertility between groups arise as a result of differences in customs, attitudes and practices which are of social origin rather than the result of biological differences. In the discussion of differential fertility therefore, our concern will be with the social factors, using social in a broad sense, which lead different groups to reproduce at different rates.

Differential fertility in India

The study of differential fertility in India has limited scope in view of the lack of adequate data for such a study and inaccuracies in the available data which may even lead to erroneous conclusions. Birth registration, as mentioned earlier does not even give us the total births occurring, much less data on the social and economic status of the parents of the children born. In fact, for the study of differential fertility, little reliance can be placed on the registration data. One is therefore forced to rely heavily upon Census data, and above all upon the child woman ratio—the ratio of children to women in the reproductive ages—as an indirect and somewhat erratic measure of fertility. Kingsley Davis has used this measure along with whatever other data that were available to him to obtain a picture of inter-caste, rural-urban, religious, educational and occupational differences.[2] His conclusions are as follows :

(1) " A consideration of rural-urban differentials during half a century indicates that the cities have not yet as in some other countries, inaugurated a general decline in the birth rate. The rural-urban differentials are certainly present, and are correlated with size of city but they have not increased in fifty years."

(2) " An analysis of caste fertility on the basis of social status, occupation and literacy shows that in the Indian region, as in most other areas, fertility is inversely correlated with social position. But the explanation does not apparently lie primarily in the use of contraception by the higher castes as a westerner might expect, but rather in the fact that non-marriage especially in the form of widow celebacy, is much higher in the upper classes."

(3) " The religious differentials also demonstrate the role of non-marriage in controlling the Indian birth rate. The superiority of Muslim and tribal fertility over the Hindu is due in past to their greater toleration of widow remarriage. Here there are also some important differences in the fertility of married couples, but the exact causes are not clear."

---

[1] Warren S. Thompson, *Population Problems*, McGraw-Hill, New York, 1953.

[2] Kingsley Davis, *The Population of India and Pakistan*, Princeton, 1951, p. 80.

Kingsley Davis has concluded that "Indian fertility, though very high, is not the highest in the world. Nor does it approach the theoretical maximum allowed in biology. It is controlled to a considerable degree by indirect, institutional, non-deliberate customs, such as the taboo on widow remarriage. The presence of such institutional controls does not suggest that fertility will decline soon in India and Pakistan. On the contrary there is a possibility that under Western influence the effect of such controls will be lessened, because some of them seem objectionable to modern opinion. Some compensation may arise from the tendency, under western influence to postpone marriage, but this may not equal the effect of greater liberality with reference to widows. At any rate, no sharp decline in the birth rate can be expected until deliberate control by means of contraception, sterilisation, abortion, etc., is inaugurated. To-day there is no real evidence that such methods are being adopted by any wide sector of the population. It may take a considerable while for such controls to displace the indirect kind now being unconsciously practised. All told, the observer inevitably reaches the melancholy conclusion that an early and substantial decline of fertility in India seems unlikely unless rapid changes not now known or envisaged are made in Indian life." These observations were made by Davis in 1951 and with reference to India as a whole. It is of interest to examine how far these conclusions are valid for the present day Madras.

Rural-Urban differentials

The experience of demographically advanced countries has shown that any fall in fertility manifests itself first in urban areas and gradually extends to rural areas. Furthermore, the larger the city, the lower its fertility, so that there is an inter-city as well as rural-urban differential. We cannot expect this differential to be significant in India, since very little of the Indian masses have adopted the urban way of life and many of the smaller towns are nothing but over-grown villages, the attitudes and mode of life in such towns being little different from those of neighbouring villages. However, a study of such differentials will throw light on the nature of Indian fertility and will indicate the possible future pattern.

A useful measure of fertility differentials in the absence of reliable registration data on such differentials is the child-woman ratio. In this chapter, this term is used to connote different indices at different places. But if we examine the ratios of children 0–4 to women aged 15 to 44 and that of children 5–9 to women aged 20–49 we find that Madras city has a lower fertility than the State as a whole. When the former measure is employed, it appears that in 1961, Madras city averaged only 571 children per 1,000 women in the ages 15–44, whereas the rest of the State averaged 603.

TABLE 4-1

Fertility in Madras City contrasted with rest of the State, 1901-61

Year		Madras City		Rest of the State	
		CWR_1	CWR_2	CWR_1	CWR_2
1901	...	471	546	610	676
1911	...	437	507	590	611
1921	...	396	475	541	626
1931	...	455	487	613	597
1941	...	474	579	584	651
1951	...	384	450	531	575
1961	...	571	601	603	615

A similar differential has existed even in every one of the preceding censuses starting from 1901. Strictly speaking we cannot consider this as a rural-urban differential, because the rest of the State includes a number of towns, but we may however take this as an approximation to a rural-urban differential.

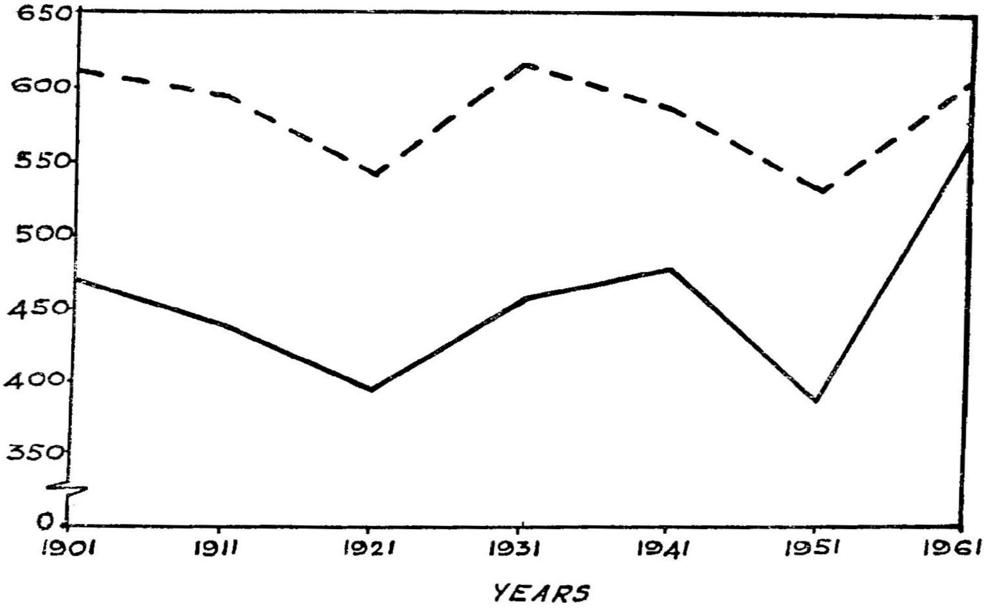
One possible reason for the low figure in the city is a possibly high infant mortality so as to exaggerate the rural-urban difference in the child-woman ratio. This can also happen because of the prevailing custom of pregnant women particularly from the urban areas to return to their home villages for confinement. On the other hand, the enumeration of children aged 0 to 4 is likely to be better in the city than in the other districts and this is likely to minimise the differential. Since these factors operate in opposite directions, we can safely assume that they may cancel each other leaving the child woman ratio as a fairly good indicator of rural-urban differential in fertility. Therefore we may accept the evidence of the above data that there is a

CWR_1 : Average number of children 0—4 per 1,000 women aged 15—44.

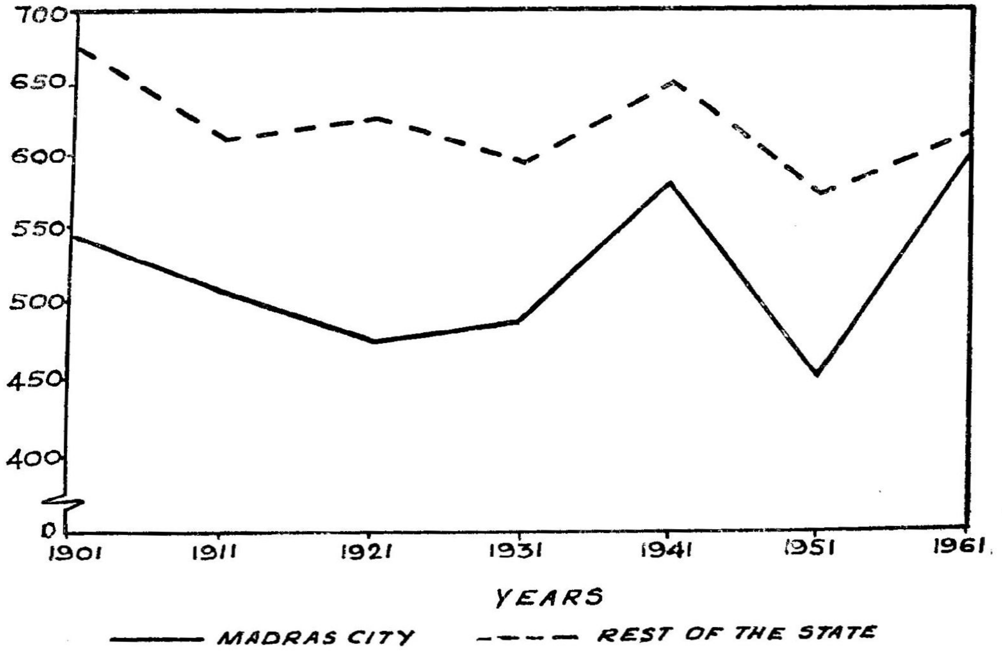
CWR_2 : Average number of children 5—9 per 1,000 women aged 20—49.

FERTILITY TRENDS IN MADRAS CITY & REST OF THE STATE

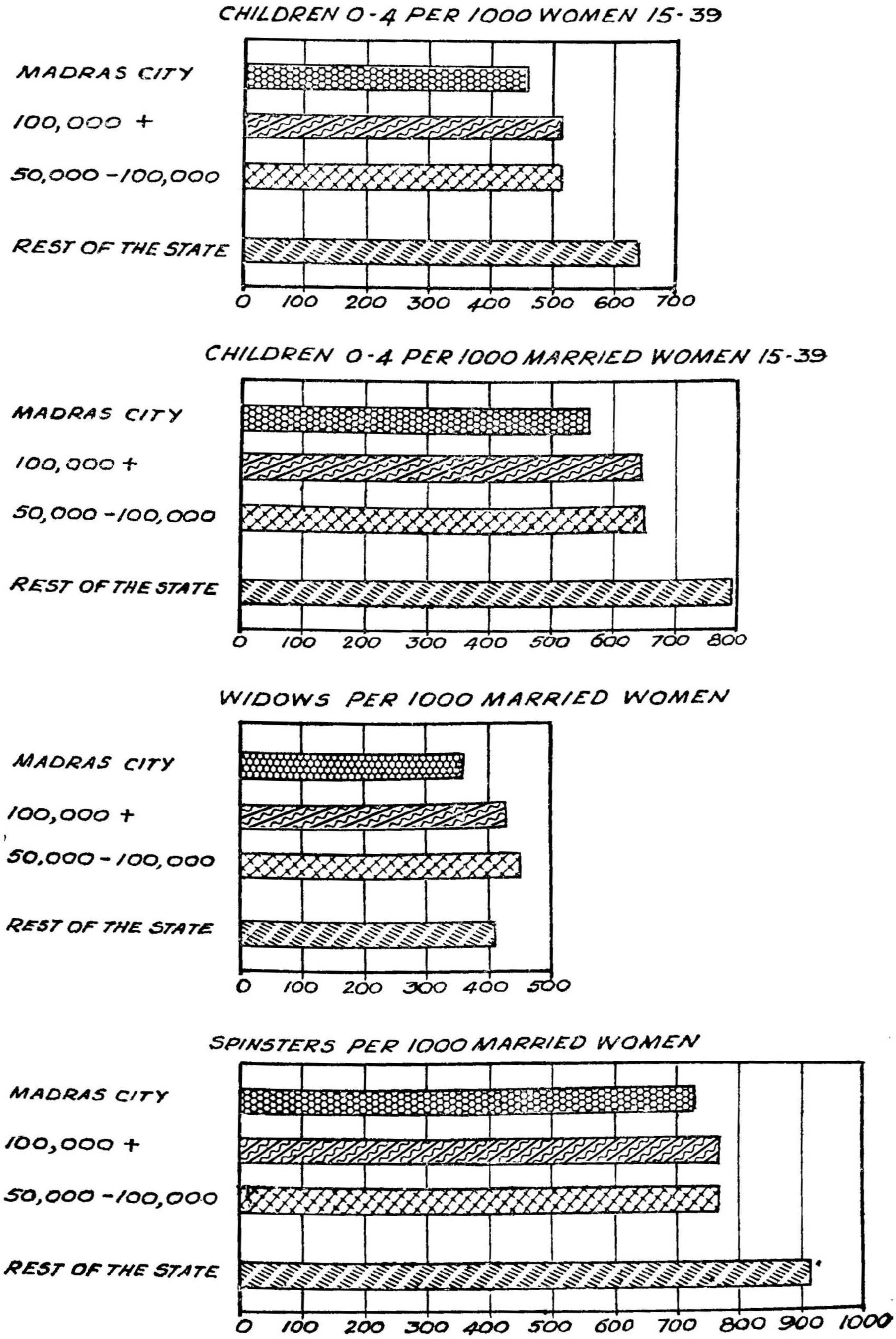
CHILDREN 0-4 PER 1000 WOMEN 15-44



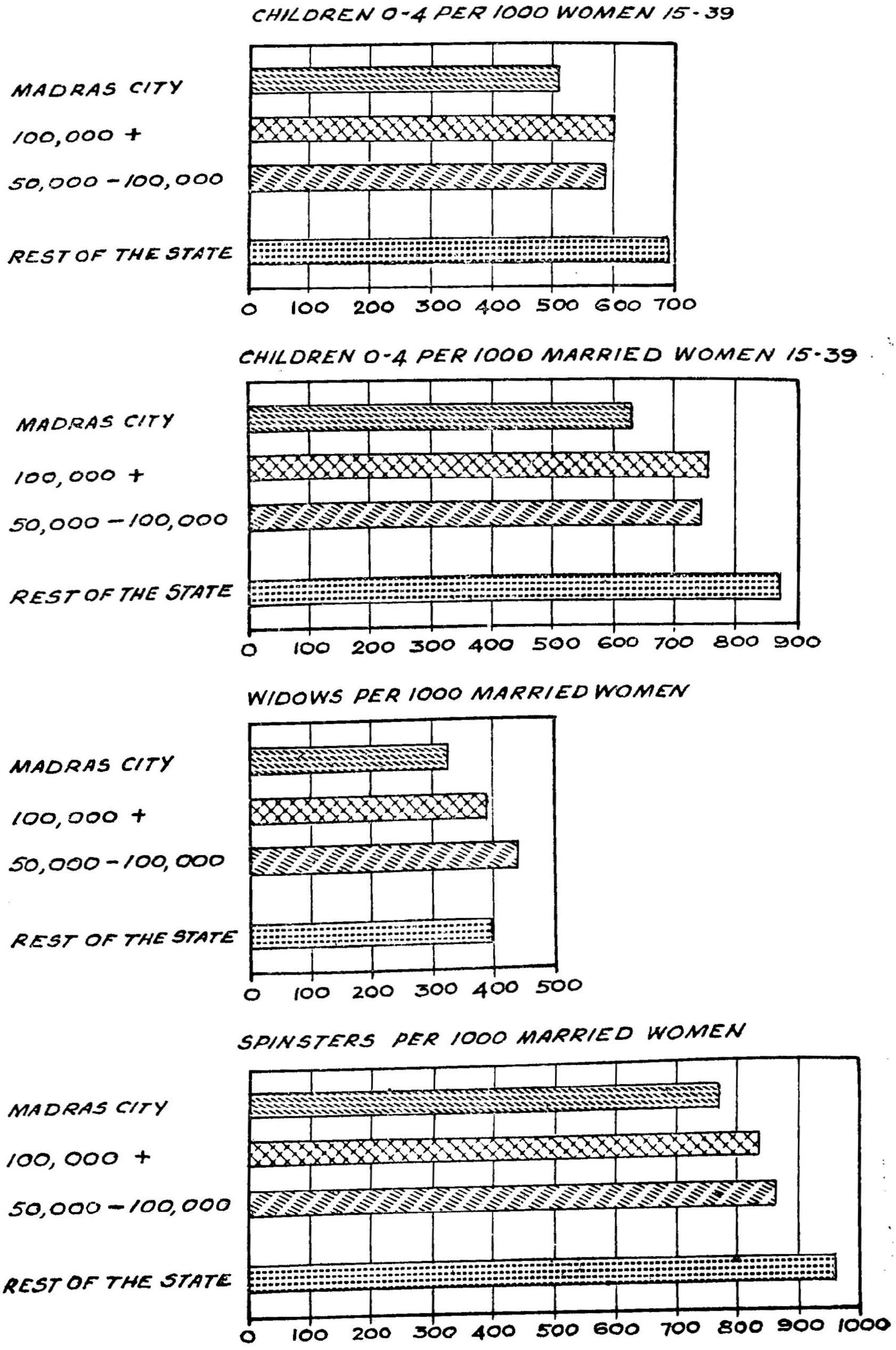
CHILDREN 5-9 PER 1000 WOMEN 20-49



FERTILITY RATIOS BY SIZE OF CITY, 1921



FERTILITY RATIOS BY SIZE OF CITY, 1931



small differential between rural and urban areas in fertility.

Cities by size

Normally, a differential in fertility exists not only between rural and urban areas but also between larger and smaller cities. In the 1921 census tables, age distributions are given for two cities of the class I (100,000 +) and 9 cities of class II (50,000—100,000) and in 1931 there were three cities in class I. Apart from these the figures for Madras city are also available. The results are shown in Table 4–2.

TABLE 4–2

Child-woman ratios by size of city (1921 and 1931)

Size class of cities	1921		1931	
	Children 0–4 per 1,000 women 15–39	Children 0–4 per 1,000 married women 15–39	Children 0–4 per 1,000 women 15–39	Children 0–4 per 1,000 married women 15–39
1. Madras City ...	454	560	504	629
2. 100,000 + ...	514	638	602	753
3. 50,000—100,000	513	648	584	745
4. Rest of Madras State ...	634	793	692	874
5. State ...	625	781	682	860

The inverse correlation between the city size and child-woman ratio is not perfect, but an examination of Table 4–2 seems to indicate that with a few exceptions the larger the city the lower the fertility. Further, the differentials between the classes of cities are just as large when the ratio of children to married women is taken as when the ratio of children to all women aged 15–39 is considered.

The following differentials are noticed. 1. the differential between the metropolitan city and the other cities. 2. the differential between these cities and the rest of the State. The differences between cities of intermediate size are not pronounced. The largest difference lies between the metropolitan city on the one hand and the remaining cities on the other.

The following figures computed from registration data do not indicate any consistent pattern in fertility with varying size classes of towns.

TABLE 4–3

Birth Rate by size of Municipal Towns, 1961

Size of Municipal area		Birth Rate
Metropolitan Madras	...	41.8
100,000 +	...	47.5
50,000—100,000 ...	...	45.0
30,000—50,000	...	39.8
20,000—30,000	...	48.8
Below 20,000	...	43.9

On the one hand, the metropolitan City of Madras reveals a lower fertility than the towns with a population of one lakh and over. This can be partly explained by the greater prevalence of contraceptive methods in the City when compared with the cities of the 100,000+ class. What is surprising is a fall in the birth rate in the subsequent groups, followed by a rise in the birth rate in the class 20,000—30,000. It is difficult to locate any definite factor which is responsible for such variation. A similar analysis with reference to density ranges gives rise to the following figures.

TABLE 4–4

Birth Rate by density ranges of Municipal areas *

Density range per square mile		Birth Rate
25,000—50,000	...	44.8
20,000—25,000	...	43.9
15,000—20,000	...	37.3
10,000—15,000	...	47.2
Below 10,000	...	43.3

The pattern observed here is once again an irregular one with a falling birth rate in the first 3 classes followed by a rise. The class of towns with density below 10,000 persons per square mile is found to have a birth rate lower than that of the towns in the 10,000—15,000 density range and is very little different from the 20,000—25,000 density range. It is difficult to explain the phenomenon.

* Based on data for only 56 Municipalities.

The following figures derived from Fertility Survey data are useful for examining whether such rural-urban differentials exist in the State :

TABLE 4-5

Age specific and marital fertility rates in rural and urban areas

Age group	Rural		Urban	
	Fertility rate per 1,000 married women	Fertility rate per 1,000 women	Fertility rate per 1,000 married women	Fertility rate per 1,000 women
15–19 ...	82	36	100	42
20–24 ...	209	183	218	182
25–29 ...	205	191	207	192
30–34 ...	158	141	155	139
35–39 ...	95	80	89	76
40–44 ...	40	29	34	24
45–49 ...	20	13	17	11

The fertility rate for all women is obtained by multiplying the fertility rate for married women by the proportions married in the respective age groups. It is seen that the fertility rate for married women is higher in urban areas than in rural areas in the age groups 15–19, 20–24 and 25–29 and in the subsequent age groups, the position is reversed and rural areas exhibit higher fertility rates for married women. The fertility rates for all women do not exhibit large differences as between rural and urban areas. The observed birth rates of 27.06 for rural areas and 27.64 for urban areas cannot be taken as significantly different. The crude birth rate and the General Fertility Rate suffer from the defect that they are influenced by variation in the composition of the population. Wherever the age specific fertility rates are known it is possible to account for such differences by a process of standardisation. This is done by using a fixed set of weights, *i.e.*, the standard population structure.

Employing the same notation as in Chapter III but using the symbol ${}^{s}F^{m}$ to indicate the standard married female population, we get

Standardised Marital Fertility Rate =

$$\frac{\Sigma\, {}^{s}F^{m}_{x}\, f_x}{\Sigma\, {}^{s}F^{m}_{x}}$$

The fertility rates for married women and the corresponding standardised rates are given below for comparison.

Rural/Urban	Fertility rates per married woman	
	Observed Rate	Standardised Rate
Rural ...	0.139	0.141
Urban ...	0.145	0.143

These standardised rates for rural and urban areas do not appear to be significantly different and hence we may conclude that no rural-urban differential in fertility exists in the State.

TABLE 4-6

Child-woman ratios for Cities with their population, ranks, (1921 & 1931)

City	1921			1931		
	Rank in population	CWR_1	CWR_2	Rank in population	CWR_1	CWR_2
Madras ...	1	454	560	1	504	629
Madurai ...	2	505	619	2	569	702
Tiruchirapalli...	3	525	662	3	545	716
Salem ...	10	611	816	4	750	894
Coimbatore ...	4	595	773	5	671	848
Thanjavur ...	7	489	623	6	546	711
Kanchipuram...	5	524	634	7	566	697
Kumbakonam	6	420	529	8	520	662
Tuticorin ...	14	...	...	9	558	709
Cuddalore ...	11	541	674	10	631	811
Vellore ...	12	602	754	11	659	830
Tirunelveli ...	9	451	574	12	532	685
Palayamcottai ..	13	...	...	13	547	724
Nagapattinam...	8	413	505	...	...	...

Note : CWR_1 = The number of children aged 0–4 per 1,000 women aged 15–39.
CWR_2 = The number of children aged 0–4 per 1,000 married women aged 15–39.

TABLE 4-7

Child-woman and other ratios by size of City, 1921

Size Class of Cities	Children 0–4 per 1,000 women 15–39		Children 0–4 per 1,000 married women 15–39		Widows per 1,000 married women	Spinsters per 1,000 married women
	Ratio	% to rest of Madras	Ratio	% to rest of Madras		
1. Madras city	454	71.6	560	70.6	362	727
2. 100,000 + ...	514	81.1	638	80.5	426	768
3. 50,000—100,000	513	80.9	648	81.7	452	768
4. Rest of Madras	634	100.0	793	100.0	409	914

TABLE 4-8

Child-woman and other ratios by size of City, 1931

Size Class of Cities	Children 0–4 per 1,000 women 15–39		Children 0–4 per 1,000 married women 15–39		Widows per 1,000 married women	Spinsters per 1,000 married women
	Ratio	% to rest of Madras	Ratio	% to rest of Madras		
1. Madras City	504	72.8	629	72.0	324	767
2. 100,000 + ...	602	87.0	753	86.2	389	836
3. 50,000—100,000	584	84.4	745	85.2	434	860
4. Rest of Madras	692	100.0	874	100.0	396	956

The reason for rural-urban differences

Several reasons can be attributed to the inverse correlation between fertility and the extent of urbanisation. It is probable that women in the larger cities use contraception to a greater degree than those of smaller cities and rural areas. Some evidence of this is available in the studies conducted in several parts of India[1]. But its effect cannot be appreciable. Another aspect that may be examined is whether widowhood and non-marriage have anything to do with the rural-urban differential. As will be seen later on, the taboo on widow remarriage will explain much of the caste and religious differentials in fertility and this factor may perhaps explain a rural-urban differential as well. As pointed out before, no variation is noticed in the rural-urban differences in the ratios in terms of all women as well as married women. Also the ratio of widows to married women in the given ages does not vary consistently with the size of the community. Although the proportion of never married women tends to be somewhat larger in the cities than in the rest of the State, the size of this group is so small that it can have no marked effect on fertility. Therefore, non-marriage or postponement of marriage alone cannot explain a lesser fertility in the cities.

As discussed in the earlier sections, several factors—social, economic, political and demographic influence fertility constantly. While it is improper to overlook past demographic events, it is nevertheless difficult to quantify their contributions to any degree of exactness. The result is often that the demographer is constrained to make numerous assumptions to fill the vacuums in knowledge of demographic facts and often the conclusions are also as wild as the assumptions. In the present study certain fertility measures such as the birth rate have been computed for rural and urban areas. It is of interest to examine how far these are related to current demographic factors, if not to the past. The common population variates affecting birth rate are the marital status, sex ratio, and age composition. It is possible to relate the birth rate to these variates with the help of the following model.

$$BR = A \times B \times C \times D.$$

where A: fertility rate per 1,000 married women in the ages 15–49.

B: Proportion of married women in the ages 15–49.

C: Proportion of women in the ages 15–49 to all women.

D: Proportion of females in the population.

This model enables the dissection of the observed birth rates for rural and urban areas into its component elements as follows :—

Rural/ Urban	Birth Rate	A	B	C	D
Rural ...	27.06	.139	.7733	.5004	.5007
Urban ...	27.64	.145	.7611	.5084	.4906

The conclusions emerging from a comparison of these figures for rural and urban areas may be summarised thus :

(1) Marital status pattern favours a lower fertility in urban areas as against rural areas.

(2) Age pattern favours a higher fertility in urban areas than in rural areas.

(3) Sex ratios in the rural and urban populations favour a higher fertility in rural areas than in urban areas.

(4) The fertility of married women is higher in urban areas (though not very much higher) than in rural areas.

(5) Because of the opposite tendencies observed here, the resultant birth rates for urban and rural areas do not differ significantly.

In conclusion it appears that although there are some differentials between a large city like Madras on the one hand and rural areas as well as other towns on the other hand, the differentials are not significant when we compare rural areas and urban areas as a whole.

[1] Vide C. Chandrasekhar & Muktha Sen : "Enquiry into the Reproductive patterns of Bengali Women." This study shows that 38 % of women in a wealthy section of the city, 13 % in a lower middle class Hindu section and 3 % in a lower middle class Muslim section practise contraception whereas the percentage in rural areas is only 0.3 %.

TABLE 4-9

Specific Fertility Rate (Per 1,000 Married Women) by Socio-Economic Classes Based on Fertility Survey, 1961

Age Group		All Classes	By Educational Attainment of Husbands			By Religion			By Educational Attainment of Wives		
			Formal Schooling below High School	High School	Graduated	Hindu	Muslim	Christian	Formal Schooling below High School	High School	Graduated
Rural											
12 & below	...	...	...	...	...	...	...	...	...	...	...
13—17	...	96	72	83	...	97	108	34	63	...	...
18—22	...	191	176	156	263	189	254	218	160	167	...
23—27	...	219	198	273	182	217	205	262	213	160	...
28—32	...	176	186	188	182	174	154	229	178	176	...
33—37	...	121	113	68	...	120	102	160	130	91	...
38—42	...	61	65	60	...	60	47	87	76	...	...
43—47	...	22	13	...	...	21	15	46	14	...	...
48 +	...	3	7	...	...	2	31	7	...	...	...
Total *	...	132	136	151	126	131	144	155	149	125	...
Urban											
12 & below	...	...	...	...	...	...	...	...	...	...	...
13—17	...	110	93	100	...	117	79	71	149	444	...
18—22	...	217	230	210	279	219	187	260	225	223	...
23—27	...	210	195	223	233	211	147	287	226	208	174
28—32	...	176	203	154	190	170	176	249	248	156	235
33—37	...	115	110	106	71	118	92	106	106	102	200
38—42	...	60	51	49	11	60	38	88	53	39	...
43—47	...	15	14	17	14	14	14	29	12	29	...
48 +	...	2	...	6	9	2	...	4	9	...	...
Total *	...	141	150	141	140	140	124	170	176	159	141

* Births per 1,000 married women of all ages.

TABLE 4-9—(*Contd.*)

Age Group		By Nature of Work							
		Technical (T)	Adminis-trative (A)	Clerical (C)	Sales Workers (S)	Farmers (FA)	Hunters (H)	Skilled Workers (P)	Unskilled Workers (W)
					Rural				
12 & below	...	...	...	...	...	...	...	...	...
13—17	...	118	200	333	...	99	...	103	131
18—22	...	179	195	167	206	183	303	220	181
23—27	...	248	278	264	265	182	337	207	217
28—32	...	170	238	173	189	166	210	226	150
33—37	...	120	141	100	125	113	214	170	117
38—42	...	114	34	88	67	54	131	84	72
43—47	...	...	149	...	23	22	121	9	40
48 +	...	...	28	...	...	3	...	6	4
Total *	...	147	172	159	149	121	211	160	128
					Urban				
12 & below	...	...	...	...	...	...	...	...	...
13—17	...	56	133	271	59	56	...	106	247
18—22	...	230	284	220	194	183	216	199	235
23—27	...	195	211	228	199	128	208	194	214
28—32	...	175	207	166	164	129	286	154	178
33—37	...	125	121	113	91	101	191	113	125
38—42	...	46	54	27	58	54	158	78	63
43—47	...	10	11	34	4	19	...	14	6
48 +	...	7	9	13	2	3	...	...	...
Total *	...	136	152	159	127	94	167	141	160

* Births per 1,000 married women of all ages.

TABLE 4-9—(*Contd.*)

Age Group		By Nature of Industry						
		Agriculture other than farming	Quarrying and Mining	Manu-facture	Building and Construction	Commerce	Transport	Services
				Rural				
12 & below	...	...	...	...	...	...	...	...
13—17	...	125	...	108	111	36	333	113
18—22	...	220	300	197	226	207	183	220
23—27	...	190	143	209	253	247	190	258
28—32	...	148	63	225	203	167	281	189
33—37	...	97	83	168	267	110	94	108
38—42	...	172	...	92	29	67	...	93
43—47	...	100	...	8	143	16	...	10
48 +	...	...	...	8	...	...	...	4
Total *	...	148	106	156	178	140	161	155
				Urban				
12 & below	...	...	...	...	...	...	...	...
13—17	...	100	...	248	130	96	224	182
18—22	...	214	200	216	207	233	242	221
23—27	...	217	111	205	229	216	270	208
28—32	...	333	200	167	117	191	193	166
33—37	...	146	...	134	52	101	146	109
38—42	...	200	...	59	20	47	71	53
43—47	...	...	...	12	16	6	13	23
48 +	...	...	...	4	...	...	...	6
Total *	...	180	91	154	120	180	186	145

* Births per 1,000 married women of all ages.

The trend of the Rural-Urban differential

In the demographically advanced countries of the West a decline in fertility has generally begun in the cities and then spread to the villages and according to the theory of demographic transition a similar process will take place in other countries as well. The question therefore arises whether the differentials observed here suggest the occurrence of a similar process. An answer to this question can be found only if comparable data are available for a number of years regarding the trend in the rural-urban differences. At present the analysis seems to show that the fall in fertility is not sharp, nor does it have an accelerating tendency. In 1901, the urban population of Madras State constituted only 14.0%, whereas in 1961 it has risen to 26.7%.

Religious Differentials

The following table shows the religious composition of the population of Madras State in the last 6 Censuses:

TABLE 4–10

Religious composition of Madras State Population in 1901–61

Year		% to total population		
		Hindu	Muslim	Christian
1901	...	92.5	4.2	3.3
1911	...	92.1	4.3	3.6
1921	...	92.1	4.2	3.7
1931	...	91.4	4.5	4.1
1941	...	91.1	4.9	4.0
1951	...	90.4	4.8	4.7
1961	...	89.9	4.6	5.2

We find from the above figures that the Muslim and Christian population are gaining in proportion whereas the Hindus are gradually losing. Part of the Muslim and Christian gain may be due to conversion but this cannot be the sole explanation. Migration has also not been of such a large scale as to affect the religious composition. We cannot expect this as a result of the small variations in mortality either. The other possibility is therefore the differences in fertility between the different religious groups in the State.

Data on births by religion were compiled from registration data by addressing the Municipalities for such particulars and by requisitioning similar particulars for non-municipal areas from the Office of the Director of Public Health. The birth rates for the State for 1951 to 1960 are presented in Table 4–11.

TABLE 4–11

Birth rate by religion from registration data, 1951–60

Year		Hindu	Muslim	Christian
1951	...	25.0	25.1	26.0
1952	...	28.2	27.6	26.9
1953	...	25.3	25.6	25.3
1954	...	26.5	26.4	25.7
1955	...	31.0	30.5	30.3
1956	...	27.9	29.0	27.9
1957	...	26.9	27.5	27.0
1958	...	27.1	28.3	28.3
1959	...	28.5	30.3	29.7
1960	...	27.0	28.8	26.7

Clearly, little differential between the Hindus, Muslims and Christians can be seen from these figures; but this does not rule out the possibility of such differentials since the data may be subject to different levels of registration efficiency. However, this may be treated as a first attempt for utilising the vital registration data for such an analysis and if we can understand the differentials in the registration efficiency of the three communities, it should be possible to find out the differentials in fertility by religion.

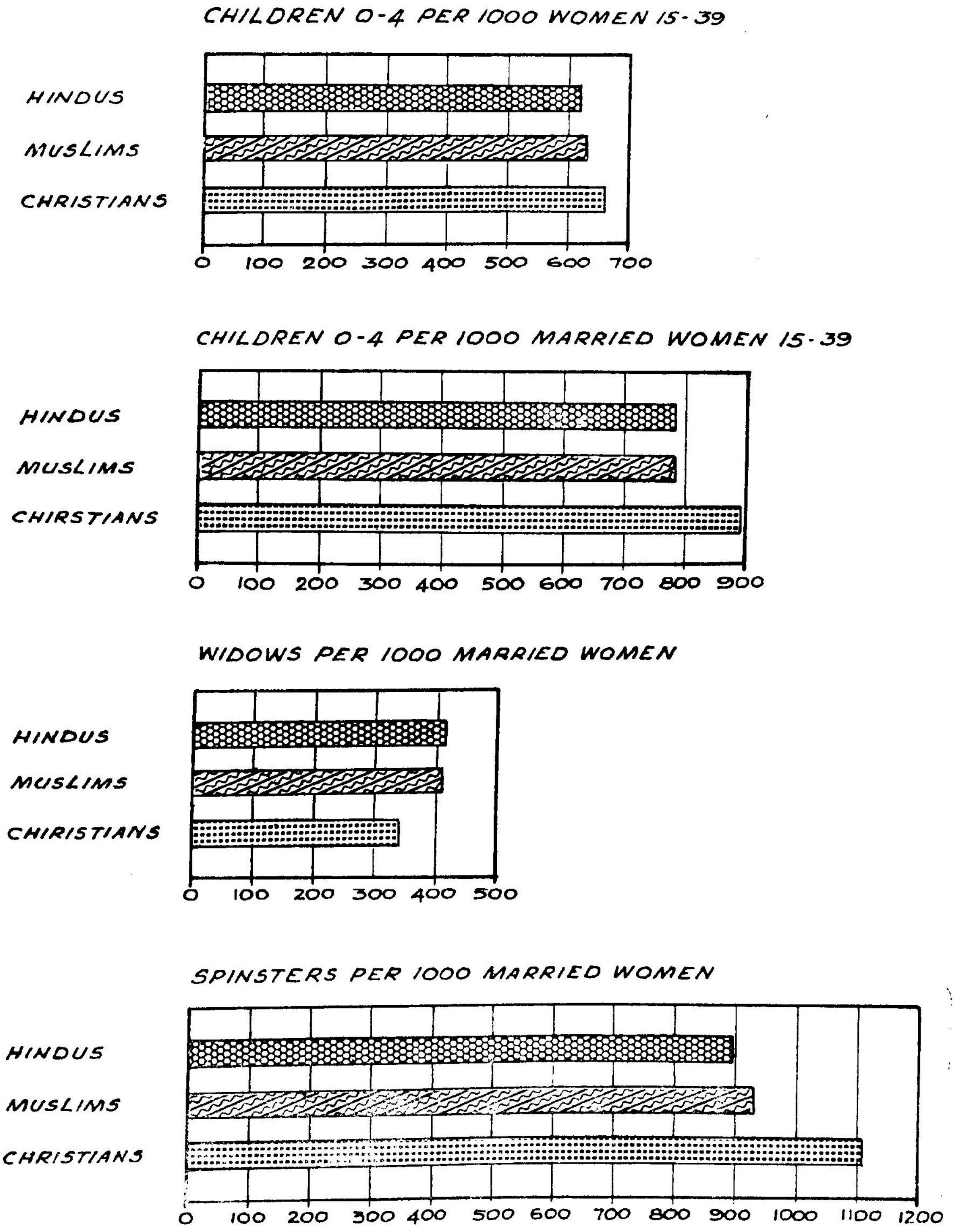
As before, we may compare the child-woman ratios for the different religions.

TABLE 4–12

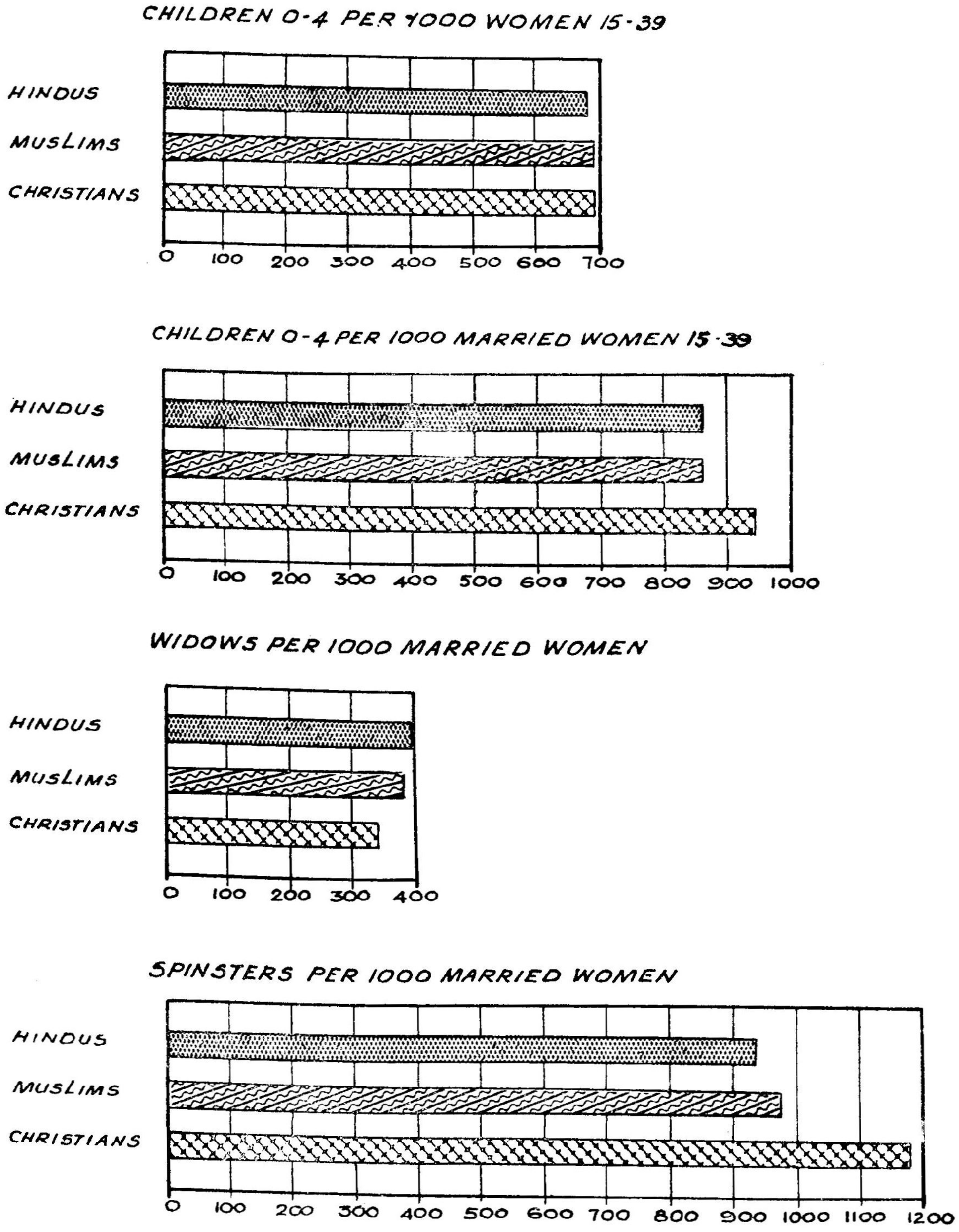
Child-woman ratios by religion, 1921 and 1931

Religion		1921		1931	
		Children 0–4 per 1,000 women 15–39	Children 0–4 per 1,000 married women 15–39	Children 0–4 per 1,000 women 15–39	Children 0–4 per 1,000 married women 15–39
Hindu	...	623	777	681	858
Muslim	...	628	776	688	859
Christian	...	659	887	691	937
Others	...	468	598	542	663
All religions	...	625	781	682	861

RELIGIOUS DIFFERENTIALS IN FERTILITY, 1921

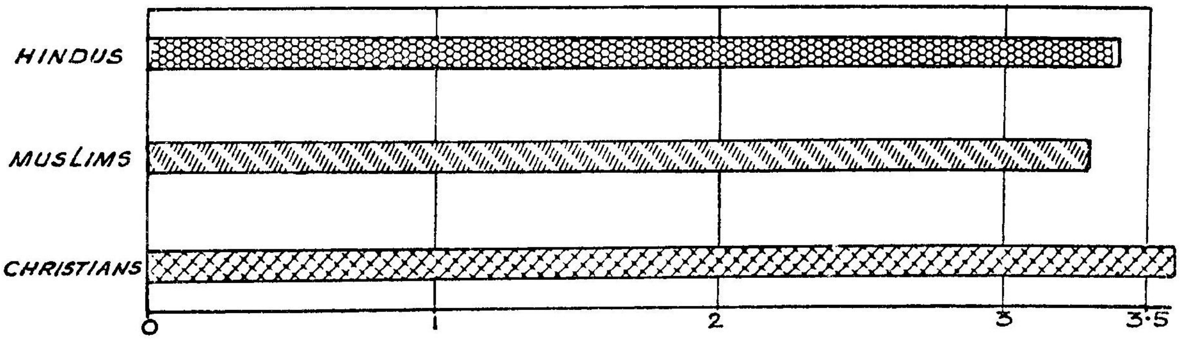


RELIGIOUS DIFFERENTIALS IN FERTILITY, 1931



FERTILITY RATIOS BY RELIGION

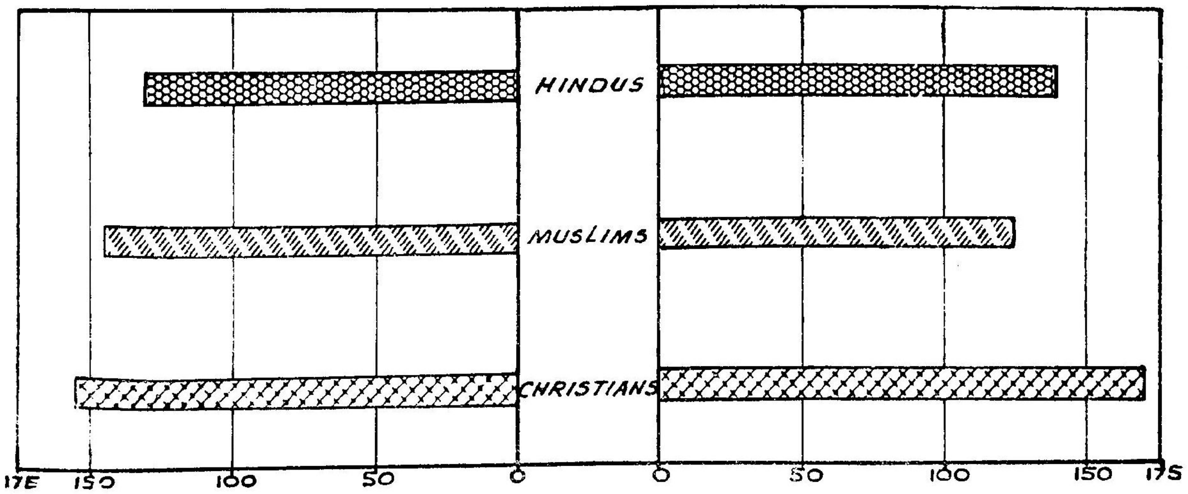
AVERAGE CHILDREN BORN PER MARRIED WOMAN



BASED ON FAMILY PLANNING SURVEY OF MADRAS CITY 1963-54

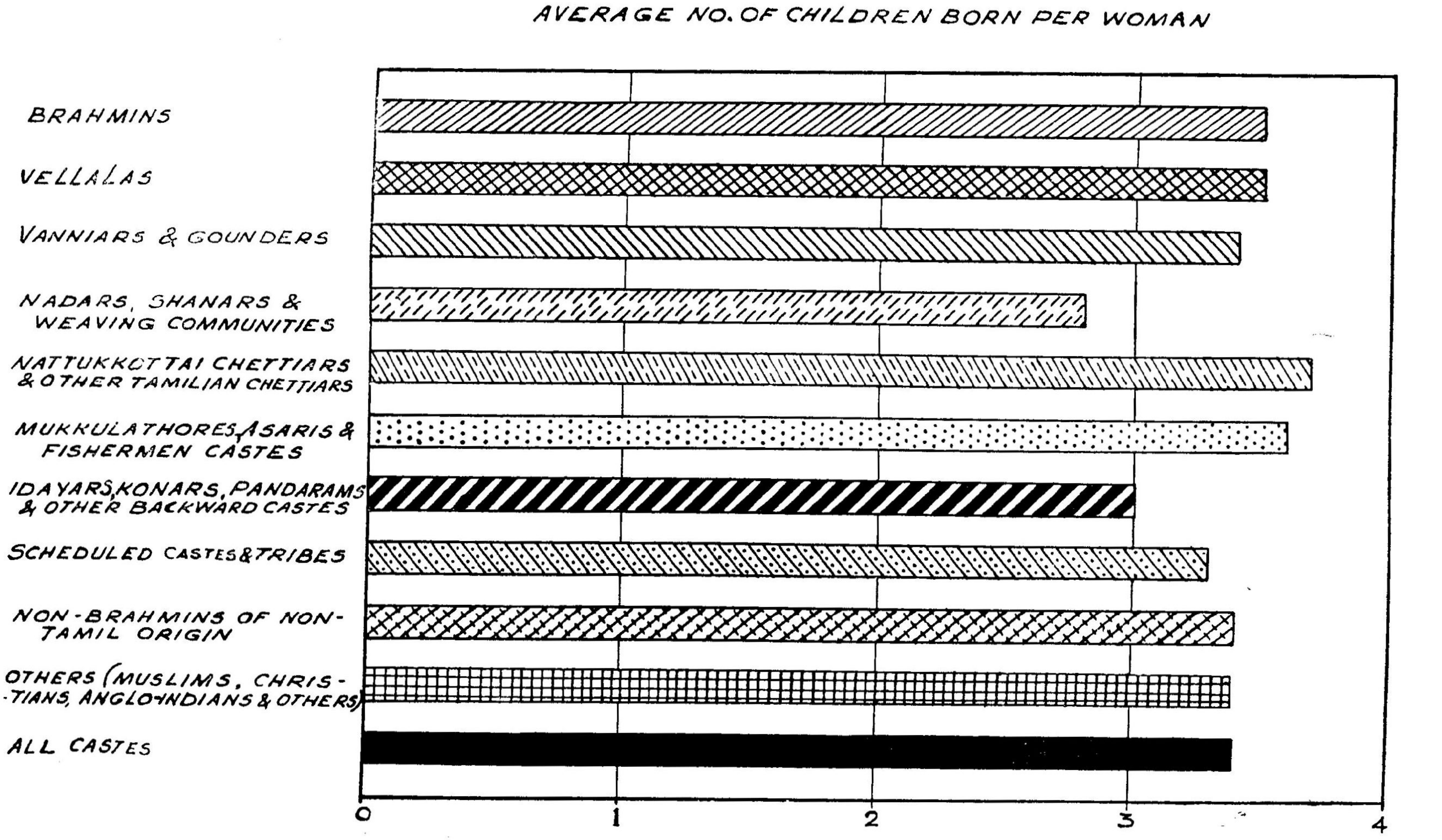
GENERAL FERTILITY RATE | GENERAL FERTILITY RATE

RURAL | URBAN



BASED ON FERTILITY SURVEY, MADRAS STATE 1961

CHILD BIRTH INDEX BY CASTES, FAMILY PLANNING SURVEY DATA, MADRAS CITY, 1963-64



These figures seem to disclose the kind of differential one may expect. Christians have the highest fertility, closely followed by Muslims. Hindus have the least fertility of all the groups. The explanation for these differentials must be related to the socio-economic status of the groups in question. It is well known that both Christians and Muslims allow widow remarriage and a good part of the difference in fertility should be traceable to this factor alone as may be seen from the following table.

TABLE 4–13

Widowhood and Spinsterhood ratios by religion, 1921 & 1931

Religion		1921		1931	
		Widows per 1,000 married women	Spinsters per 1,000 married women	Widows per 1,000 married women	Spinsters per 1,000 married women
Hindu	...	411	895	398	934
Muslim	...	405	932	381	974
Christian	...	337	1,110	339	1,182
Others	...	538	660	497	683
All religions	...	409	904	395	945

This is corroborated by the fact that the ratio of children to married women shows smaller differences between religions than does the ratio of children to all women of the specified ages. This, however, is not the sole factor, because there is a definite differential even when the non-married are excluded from the calculation.

In the Family Planning Survey of Madras city conducted in 1963–64, the four religious groups came out as follows :

TABLE 4–14

Number of children born and number surviving by religion (Family Planning Survey, Madras City, 1963–64)

Religion		Average Children born per married woman	General fertility rate (Fertility Survey data)	
			Rural	Urban
Hindus	...	3.4	131	140
Muslims	...	3.3	144	124
Christians	...	3.6	155	170

These figures strikingly confirm our findings. Here the Muslims turn out to have the same fertility as the Hindus, but the Hindus have a greater proportion of survivors, so that their effective fertility is greater. In general, however, the percentage of survivors varies positively with fertility, at least as far as religion is concerned. Hindu couples have fewer living children, not only because of low fertility but also because of high infant mortality. When we add to this the fact that there are fewer Hindu couples in proportion to the female population (because of the taboo on widow remarriage), we can see why the Hindus are steadily diminishing as a proportion of the total population.

Class and Caste differentials

Differentials of fertility between different castes should be expected on *a priori* grounds. The Brahmins for instance are often considered to have a lower fertility than the rest of the Hindu castes and the gradual decline in the proportion of Brahmin population is cited in support of this contention. Such differences in fertility between different castes cannot be proved empirically, since registration data on births are not available by caste. However, resort has been made to the data specially compiled from the schedules of the Family Planning Survey conducted by this department in 1963–64. The results are presented in Table 4–15.

TABLE 4–15

Child Birth index by Castes (Family Planning Survey, Madras City, 1963–64)

Caste		Average number of children born per woman	
		No.	Index
1. Brahmins	... ...	3.5	102.9
2. Vellalas	... ...	3.5	102.9
3. Vanniars and Gounders	...	3.4	100.0
4. Nadars, Shanars and Weaving communities	...	2.8	82.4
5. Nattukkottai Chettiars and other Chettiars	...	3.7	108.8
6. Mukkulathores, Asaris and Fishermen castes	...	3.6	105.9
7. Idayars, Konars, Pandarams and other backward castes	...	3.0	88.2
8. Scheduled Castes and Tribes	...	3.3	97.1
9. Non-Brahmins of North Indian, Kerala, Karnataka & Andhra origins	...	3.4	100.0
10. Others (Muslims, Christians, Anglo-Indians and others)	...	3.4	100.0
All Castes	...	3.4	100.0

It is seen that the average number of children born per woman is the least in the Nadars, Shanars and Weaving Communities (2.8) which is only 82% of the average for all castes. Nattukkottai Chettiars have the highest figure (3.7) which is 8.8% higher than the average for all castes. No significant variation in the child birth index is observed among the other castes. A low child birth index in the absence of differentials in recall lapse should be attributed to a lower fertility. It appears probable that the prolonged absence of the husbands in the Nadar and Shanar castes on business errands should be responsible for the lower fertility in this caste. In the Nattukkottai Chettiar caste a higher fertility could be attributed to early marriage.

From the 1961 Census data, special tables have been prepared for Scheduled Castes and Scheduled Tribes by broad age groups. In spite of their incomparability with the ratios discussed earlier, an attempt has been made to compute ratios of children aged 0 to 14 (instead of 0–4 since figures are available only for this broad age group) to women 15–44 and married women 15–44. The results are presented below :

TABLE 4–16

Child Woman Ratios for Scheduled Castes and Tribes, 1961

Scheduled Caste/Tribe	Average No. of children 0–14 per 1,000 women aged 15–44	Average No. of children 0–14 per 1,000 married women aged 15–44
Scheduled Castes ...	1,676	2,062
Scheduled Tribes ...	1,769	2,080
General Population ...	1,652	2,110

The former ratio indicates a higher fertility for both scheduled castes and scheduled tribes when compared to the general population. On the other hand, if we consider the ratio in terms of married women, the position is reversed and both scheduled castes and scheduled tribes have lower fertility when compared to the general population. This is because the proportion of married women in the scheduled castes and tribes is higher than the general population.

Occupational status

An attempt has been made to discover fertility differentials according to occupation. The data available for this purpose are derived from the Survey of Family Planning in Madras City of 1963–64. The figures are given below :

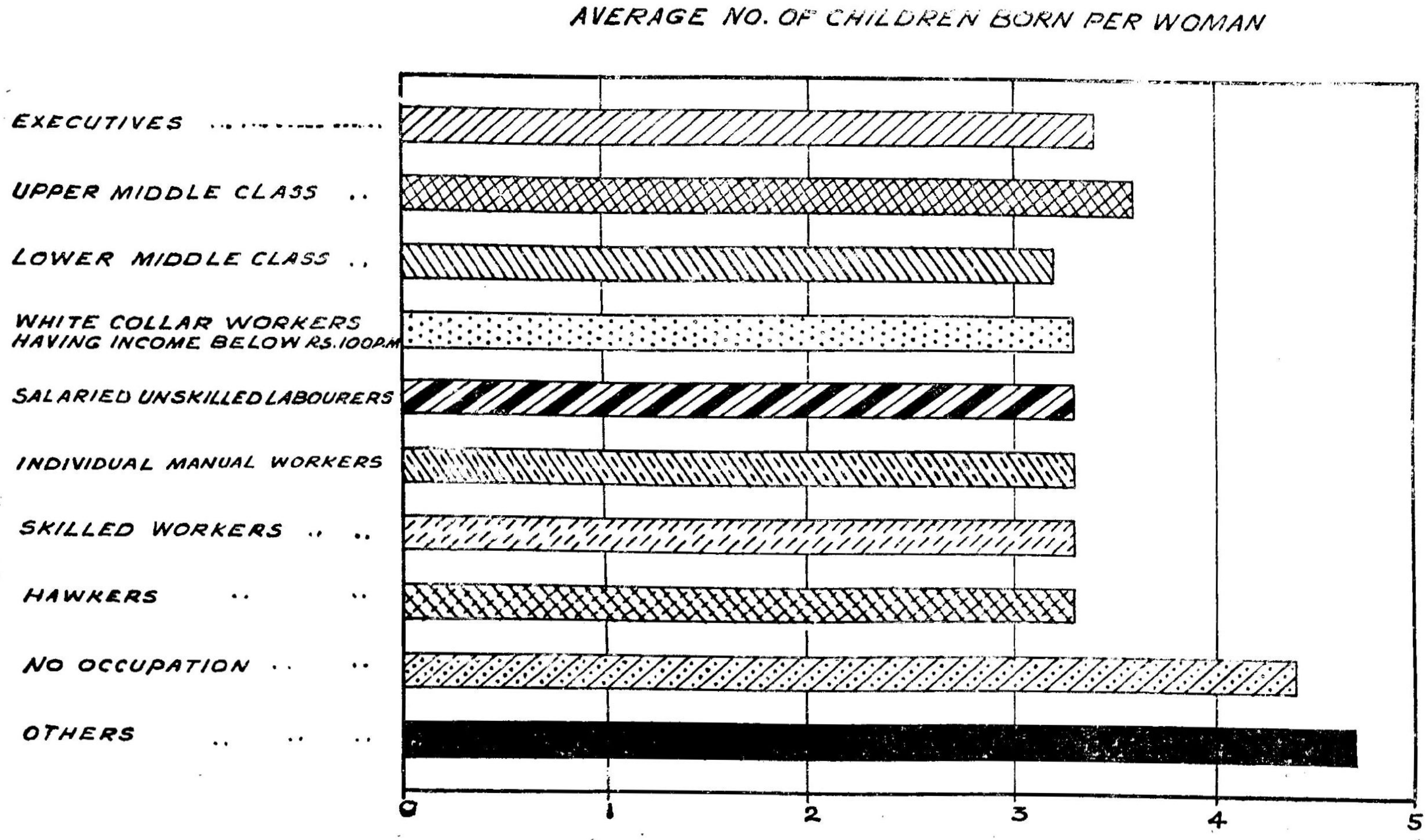
TABLE 4–17

Occupational differentials in fertility

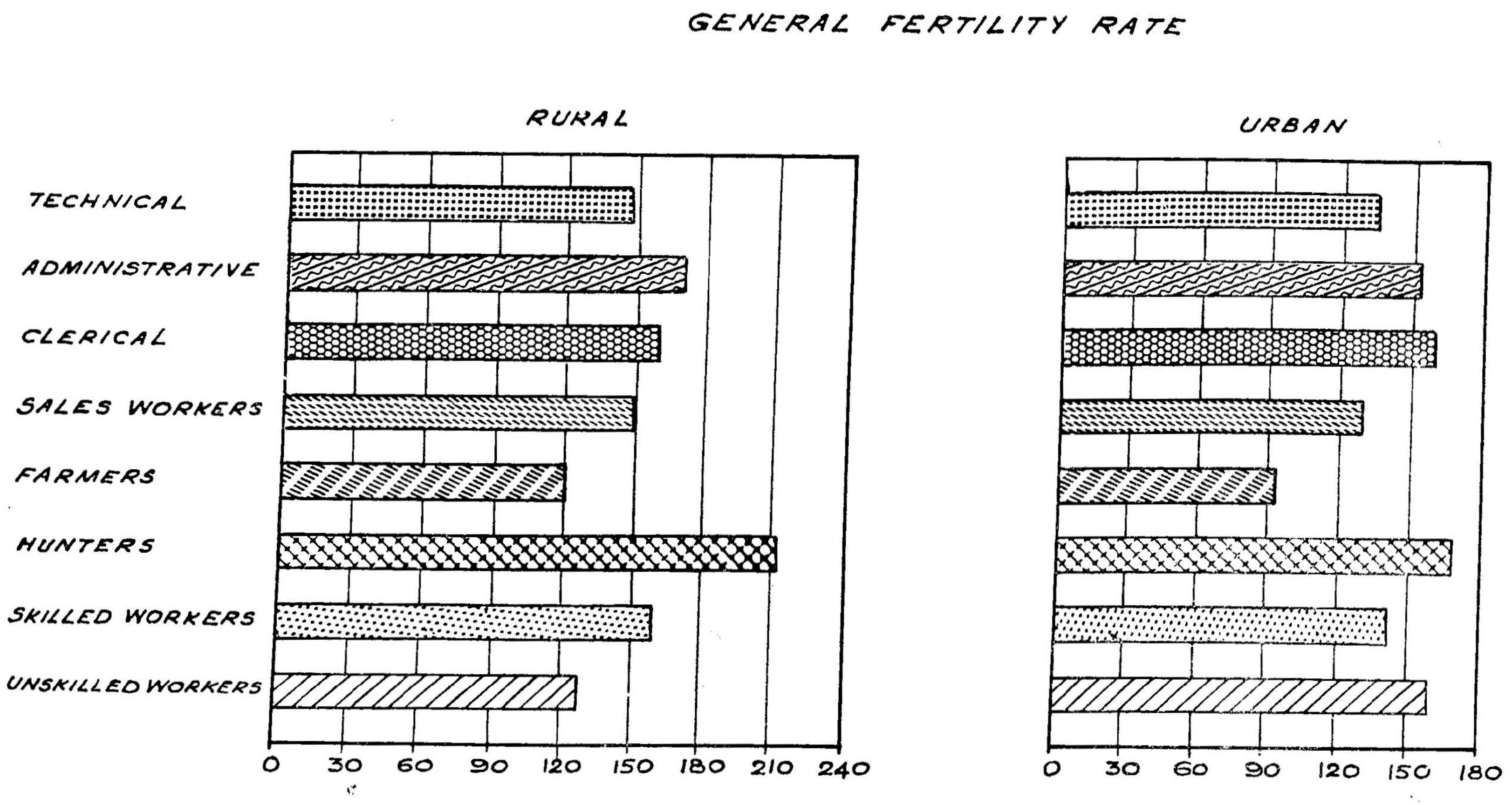
Occupation	Average No. of children born per woman	Index
A. Executives, businessmen, doctors, lawyers and others having an income of Rs. 1,000 and above per mensem ...	3.4	100.0
B. Upper middle class people having income in the range of Rs. 400–1,000 ...	3.6	105.9
C. Lower middle class people having income in the range of Rs. 100–400 ...	3.2	94.1
D. White collar workers getting income less than Rs. 100 (*e.g.*, clerks, accountants, etc.) ...	3.3	97.1
E. Salaried unskilled labourers getting income less than Rs. 100 (*e.g.*, peons, laundry workers, etc.)..	3.3	97.1
F. Individual manual workers depending on work of an intermittent nature (*e.g.*, rickshaw pullers, coolies, etc.) ...	3.3	97.1
G. Skilled workers in factories, drivers, mechanics, etc. ...	3.3	97.1
H. Petty traders, hawkers, vendors, etc. ...	3.3	97.1
I. No occupation ...	4.4	129.4
J. Others not specified above ...	4.7	138.2
All Classes ...	3.4	100.0

In the Family Planning Survey, a new type of occupational rating has been adopted, so as to provide a clue to the differentials in fertility according to social standing. The criteria is based on a joint consideration of occupation, income and the investigators' assessment of the standing of the household. There were quite a few borderline cases which were decided by one or other of these criteria. It appears that J (others not specified in the classes A to H) and I (No occupation) have the highest fertility. In the case of the former, there were only 108 women in the sample and in case of the latter the number was still less *viz.*, 82. Barring these two classes, upper middle class people have the highest

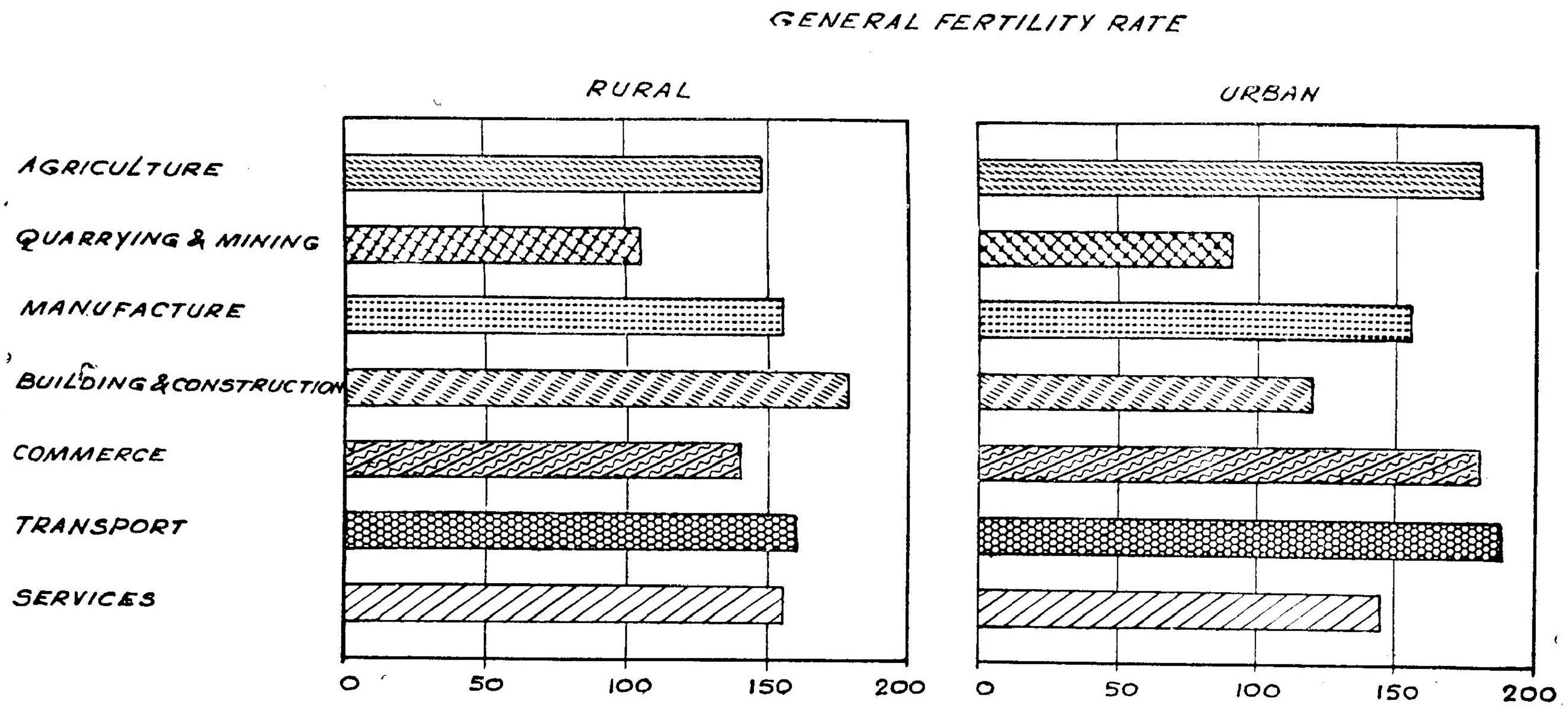
OCCUPATIONAL DIFFERENTIALS IN FERTILITY



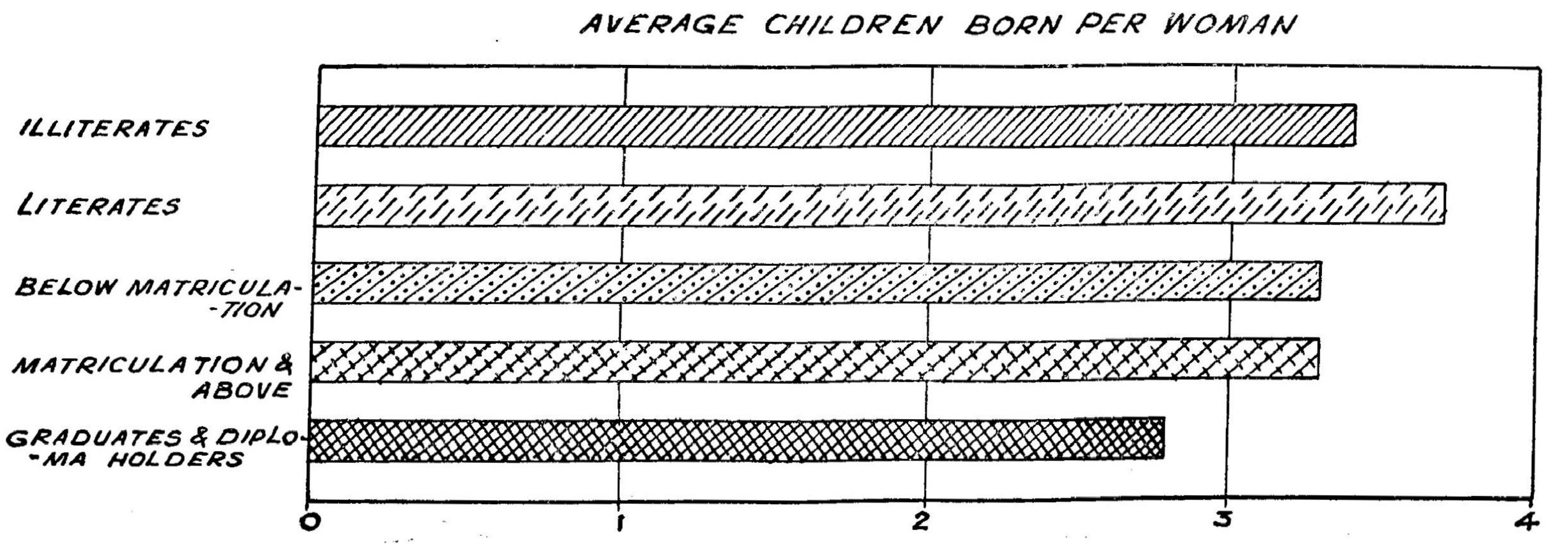
FERTILITY DIFFERENTIALS BY NATURE OF WORK



FERTILITY DIFFERENTIALS BY NATURE OF INDUSTRY



FERTILITY DIFFERENTIALS BY EDUCATIONAL ATTAINMENT



fertility. The lowest fertility is found among the lower middle class people.

In the fertility survey, we have obtained information on fertility separately by nature of work and nature of industry. The following tables show the figures separately for rural and urban areas.

TABLE 4–18

General Fertility Rate by nature of work (Fertility Survey, 1961)

Nature of work	Rural		Urban	
	Rate	Index	Rate	Index
1. Technical ...	147	111.4	136	96.5
2. Administrative ...	172	130.3	152	107.8
3. Clerical ...	159	120.5	159	112.8
4. Sales Workers ...	149	112.9	127	90.1
5. Farmers ...	121	91.7	94	66.7
6. Hunters ...	211	159.8	167	118.4
7. Skilled Workers ...	160	121.2	141	100.0
8. Unskilled Workers ...	128	97.0	160	113.5
All categories ...	132	100.0	141	100.0

TABLE 4–19

General Fertility Rate by nature of industry (Fertility Survey, 1961)

Nature of Industry	Rural		Urban	
	Rate	Index	Rate	Index
1. Agriculture other than farming ...	148	112.1	180	127.7
2. Quarrying and mining ...	106	80.3	91	64.5
3. Manufacture ...	156	118.2	154	109.2
4. Building and Construction.	178	134.8	120	85.1
5. Commerce ...	140	106.1	180	127.7
6. Transport ...	161	122.0	186	131.9
7. Services ...	155	117.4	145	102.8
All Categories ...	132	100.0	141	100.0

The highest fertility in both rural and urban areas is found among hunters and the lowest among farmers. Technical and Sales Workers are also found to have a low fertility in urban areas. The classification by nature of industry reveals the highest fertility in the Building and Construction class in rural areas and Transport class in urban areas. The second and third positions in the rural areas are held by Transport and Manufacturing classes, while in urban areas these places are occupied by classes engaged in Commerce and Agriculture other than farming. The last position in both rural and urban areas is held by Quarrying and Mining.

Literacy

In addition to social status and occupation, literacy is an important factor influencing variations in fertility. It is therefore felt that information on literacy should be examined as to throw light on the class of people having the lowest fertility. The data available for this study are mainly two, one derived from the Fertility Survey of 1961 and the other based on the Family Planning Survey of 1963–64. The averages extracted from these two important surveys are indicated in Table 4–20.

TABLE 4–20

Fertility differentials by educational attainment of husbands

Educational level	General Fertility Rate, (Fertility Survey, 1961 for Madras State)				Average number of children born per woman (Family Planning Survey, 1963–64 for Madras City)	
	Rural		Urban			
	No.	Index	No.	Index	No.	Index
1. Illiterates ...	136	103.0	150	106.4	3.4	100.0
2. Literates ...					3.7	108.8
3. Educational level below Matriculation.					3.3	97.1
4. Matriculation and above ...	151	114.4	141	100.0	3.3	97.1
5. Graduates and diploma holders in Engineering, etc...	126	95.5	140	99.3	2.8	82.4
All Classes ...	132	100.0	141	100.0	3.4	100.0

(Rows 1–3 are bracketed together for the Fertility Survey figures.)

It is evident that in the early stages, education has the effect of increasing fertility, probably due to the fact that in the initial stages, education will lead to an improvement in the standards of life, particularly with reference to saving of life due to a knowledge of hospital facilities, etc. A further increase in educational attainment leads to a decline in fertility and Graduates have the least fertility.

Type of family and type of tenancy

In the Family Planning Survey, the tabulation of the data has been attempted according to the type of family and type of tenancy. There are three family types—simple, joint and intermediate. The tenancy has been classified as huts, independent flats and portions. The fertility differentials according to these classes are seen from the following table.

TABLE 4–21

Differentials in fertility by type of tenancy and type of family (Family Planning Survey, Madras City, 1963–64)

Tenancy	Family	Average number of children born per woman	Index
Hut ...	Simple ...	3.8	111.8
	Joint ...	2.8	82.4
	Intermediate ...	2.7	79.4
	Combined ...	3.5	102.9
Independent Flats	Simple ...	4.0	117.6
	Joint ...	3.0	88.2
	Intermediate ...	3.4	100.0
	Combined ...	3.6	105.9
Portion ...	Simple ...	3.5	102.9
	Joint ...	3.1	91.2
	Intermediate ...	2.7	79.4
	Combined ...	3.3	97.1
All Tenancies ...	...	3.4	100.0

It appears that joint families and intermediate families have lower fertility than simple families and intermediate families have the least fertility. No explanation can be offered for this phenomenon. Among the different types of tenancies, those living in huts have a slightly higher fertility than the other two categories combined. This is in conformity with the higher fertility in the slum areas observed by the Slum Survey.

A picture of the differences in the fertility schedules of different classes can also be had from Table 4–9. These data are derived from the Fertility Survey which is subject to some under count; nevertheless the differentials noticed are of interest. Of the class factors discussed, *viz.*, caste, status, occupation and literacy, it is difficult to say which is the most important, but in a hierarchic society like ours, all these factors are likely to be interrelated. It is relevant to recall the remark of Kingsley Davis. " Whatever the background cause, the main mechanism through which differential fertility occurs in India is not the deliberate control of reproduction by contraception, but the indirect control of it through such institutional practices as the non-marriage of widows. This means that the existing differentials do not by themselves point to an early decline of Indian fertility ; for if the controls are indirect and institutional, a long time will be required for them to be abandoned and deliberate controls adopted. Indeed, while the institutional controls are gradually dying out and the deliberate controls are hardly yet started, fertility may actually increase." Fortunately for us, fertility has not increased during the past decade (as shown in Chapter III) and is more or less stationary during the last two decades, contrary to these fears.

There are however some interesting trends noticeable. One is the differentials by education which shows that higher the education the lesser the fertility. We have embarked upon an education programme which is likely to stamp out illiteracy and provide at least education upto matriculation level to the coming generations of young men and women. This is bound to be reflected in a fall in fertility. On the other hand there is a rather disquieting trend of a higher fertility in the simple than in the joint and intermediate families. The present day tendency is for the married couples to live separately from their parents and brothers and sisters and slowly the joint and intermediate families are disappearing. This is likely to get accelerated with the progress of education and the independent and liberal thinking that education brings. If this happens, the fertility is likely to increase as a result of the breaking up of the joint families. We have two contrary tendencies, a fall in fertility with education and a rise in fertility with the break up of joint families both happening simultaneously. What will be the result none can as yet predict. The answer to this question, may perhaps have to wait till the 1971 Census.

FERTILITY DIFFERENTIALS BY TYPE OF FAMILY & TYPE OF TENANCY

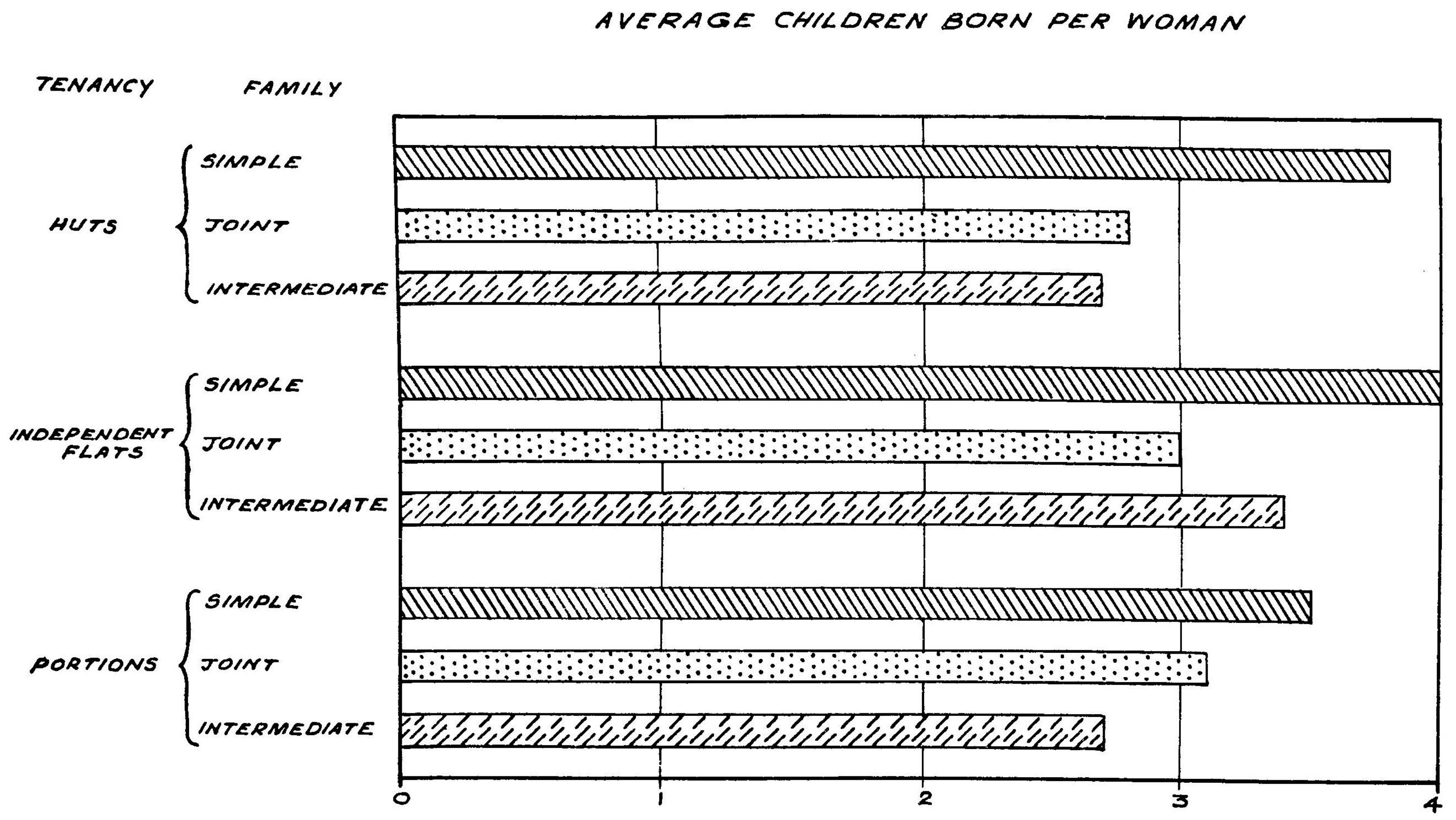


TABLE 4-22

Birth Rate by Agro-Climatic Regions, 1951-60

Agro-Climatic Regions	Districts	Rainfall Conditions	Irrigational Facilities	Cropping Pattern	Birth Rate, 1951–60
1. East Coast Region	Chingleput, North Arcot, South Arcot and Tanjore	Here normal annual rainfall is above 1,000 mm. Retreating monsoon (Oct.—Jan.) rainfall is high (above 900 mm). Advancing monsoon (June—Sept.) rainfall is low (below 400 mm).	About 58% of net sown area is irrigated. Canal irrigation assumes exceptional importance in agriculture of Tanjore district (94% of the net area irrigated by canals). Tank irrigation is predominant in other districts.	Paddy is the predominant crop. Oil-seeds and millets are subsidiary crops.	26.9
2. Northern Region	Salem district ...	Annual rainfall is between 800–900 mm. June — September rainfall is medium (400–600 mm). Oct.—Jan. rainfall is low (200–400 mm).	About 20% of the net sown area is irrigated. Well irrigation accounts for more than 50% of the total irrigated areas.	Millet is the predominant crop. Pulses and oil-seeds are subsidiary crops.	23.4
3. North-western Region	Coimbatore district ...	Annual rainfall is between 600–800 mm. Rainfall for both retreating and advancing monsoon is below 400 mm.	About 29% of the net sown area is irrigated. Well irrigation is more predominant.	Millet is the major crop. Oil-seeds, cotton and pulses are subsidiary crops.	25.2
4. West Central Region	Tiruchirapalli and Madurai districts	Annual rainfall is between 700–900 mm. Rainfall for both the retreating and advancing monsoons is moderately low (400–600 mm).	About 30% of the net sown area is irrigated by tanks, canals and wells.	Millet is the staple crop. Rice, pulses and cotton are subsidiary crops.	26.3
5. South-eastern Region	Tirunelveli and Ramanathapuram districts	Annual rainfall is below 900 mm. Oct.—Jan. rainfall is medium (400–600 mm). June—September rainfall is very low (below 125 mm).	About 37% of the net sown area is irrigated. Tank irrigation is overwhelmingly important, accounting for 95% of the net irrigated area.	Rice and millet are important. Rice is grown along the river by canal irrigation. Millet is, on the other hand, non-irrigated crop. Cotton, oil-seeds and pulses are subsidiary crops.	28.3
6. South-western Region	Kanyakumari district.	Annual rainfall is about 1,000 mm.	About 50% of the net sown area is irrigated. Tank irrigation is practised.	Paddy is the predominant crop. Fruits, vegetables and cocoanuts are subsidiary crops.	23.0
7. Western Hill Region	Nilgiris district, Palni taluk of Madurai district	Annual rainfall is above 1,000 mm.	Only 1% of the net sown area is irrigated.	Tea and coffee are the predominant crops. Vegetables, millets and paddy are subsidiary crops.	29.9

Differential Fertility Index (DFI)

The search for suitable indicators of differential fertility has engaged the attention of statisticians for a long time and specific indicators like the birth rate, general fertility rate, child woman ratio are commonly employed, but none of these is suitable in view of the data situation of underdeveloped countries. It is difficult to measure differentials in fertility from the incomplete and inaccurate vital registration data. An alternative index available is the child woman ratio, but the child woman ratio is iteslf affected by differentials in infant mortality and also differences in under enumeration of infants. The infant mortality rate is itself subject to omissions in the infant deaths as well as live births, but the relative error may be assumed to be the same in all districts. The relative error is likely to be higher in rural areas than in urban areas, but it is striking that in all districts the rural areas have a higher infant mortality rate in spite of this factor. This clearly shows that the mortality level in rural areas is definitely higher than the mortality level in urban areas; but for the purpose of our argument we may ignore the effect of this factor. We may also make the assumption that the enumeration error in the 0—4 age group does not vary considerably from district to district.

Under the above assumptions we can arrive at a Differential Mortality Index (DMI) on the following lines.

Let C_{0-4} represent the children aged 0—4 in a given Census and F_{15-44} the number of women enumerated in the same Census. Then the Child Woman Ratio (CWR) is given by

$$CWR = \frac{C_{0-4}}{F_{15-44}}$$

If ISR denotes the Infant Survival Rate or the complement of the Infant Mortality Rate, we can compute the ratio (λ) of the Child Woman Ratio to the Infant Survival Rate expressed in terms of 1,000.

$$\lambda = \frac{CWR}{ISR} \times 1,000$$

The value of λ can be computed for each district and for rural and urban areas separately. Denoting the value for the district i by λi and that of the State by λ, the Differential Fertility Index (DFI) is given by

$$DFI = \frac{\lambda i}{\lambda}$$

The computed values of DFI for the rural and urban areas of each district are presented in Table 4–23.

We find a value of less than 100 for Madras, Coimbatore, Tiruchirapalli, Thanjavur, Ramanathapuram and Tirunelveli Districts. This indicates that fertility in these districts is below the level for the State. In the remaining districts, *viz.*, Chingleput, North Arcot, South Arcot, Salem, Nilgiris and Kanyakumari, the fertility is higher than that of the State as a whole. Nilgiris has an index of 113 which is the highest noticed and North Arcot District comes next with an index of 112. Coimbatore and Tiruchirapalli have the lowest index (92). This shows that Nilgiris and North Arcot have fertility rates which exceed the fertility rate for the State by 13 and 12 per cents respectively and the fertility rate for Coimbatore and Tiruchirapalli is 8% less than the rate for the State. The metropolitan City of Madras has only a slightly lower fertility than the State.

We may now compare the indices for rural and urban areas for different districts. In general, we notice a higher fertility in rural areas than in urban areas, the exception being Coimbatore and Madurai districts where the opposite tendency is found. For the State as a whole the difference in fertility between rural and urban areas is not significant—a conclusion which is borne out by our earlier discussions. Among rural areas the highest index recorded (115) is in respect of North Arcot and Nilgiris districts and the least figure (90) is recorded in respect of Coimbatore district. The urban index is the highest in respect of Nilgiris (110) and least in respect of Tiruchirapalli, Thanjavur and Tirunelveli districts (90).

While the DFI gives an indication of the level of fertility in the rural and urban areas of different districts in relation to that of the State, it is possible to compute the probable birth rate for each district, if the birth rate for the State is known. We have found by the Reverse Survival Method that the birth rate for the State for the 1951–60 decade is 35 per 1,000 of the population. Once this figure is accepted and the concept of DFI as a relative measure of fertility is also agreed upon, it is possible to compute the birth and death rates for each district, and also separately for the rural and urban areas. We have made such an attempt and the birth rates for different districts are presented in Table 4–24.

TABLE 4–23

Computation of Differential Fertility Index (DFI) for Rural and Urban Areas

District	Children 0–4 in 1961			Women 15–44 in 1961			Child Woman Ratio			Infant Survival Rate			CWR / ISR × 1,000			DFI		
	Total	Rural	Urban	Total	Rural	Urban	T	R	U	T	R	U	T	R	U	T	R	U
Madras ...	228,927	...	228,927	400,933	...	400,933	571	...	571	854	...	854	669	...	669	99	...	99
Chingleput ...	310,961	249,387	61,574	489,589	385,225	104,364	635	647	590	874	871	891	727	743	662	108	110	98
North Arcot ...	460,914	374,530	86,384	688,177	545,928	142,249	670	686	607	886	884	895	756	776	678	112	115	101
South Arcot ...	436,331	381,437	54,894	687,138	598,787	88,351	635	637	621	891	885	921	713	720	674	106	107	100
Salem ...	534,900	447,272	87,628	836,875	698,516	138,359	639	640	633	905	901	922	706	710	687	105	105	102
Coimbatore ...	450,171	310,639	139,532	801,955	569,230	232,725	561	546	600	904	902	908	621	605	661	92	90	98
Nilgiris ...	62,359	35,883	26,476	90,589	51,271	39,318	688	700	673	908	908	908	758	771	741	113	115	110
Madurai ...	447,811	306,296	141,515	743,729	511,512	232,217	602	599	609	896	895	898	672	669	678	100	99	101
Tiruchirapalli...	415,647	326,141	89,506	748,455	589,030	159,425	555	554	561	896	888	921	619	624	609	92	93	90
Thanjavur ...	427,337	342,130	85,207	759,659	606,976	152,683	563	564	558	897	886	924	628	636	604	93	95	90
Ramanatha-puram ...	337,817	256,774	81,043	575,443	433,780	141,663	587	592	572	909	909	909	646	651	629	96	97	93
Tirunelveli ...	356,495	249,296	107,199	635,003	434,621	200,382	561	574	535	882	881	885	636	652	605	95	97	90
Kanyakumari...	140,099	119,795	20,304	210,811	178,247	32,564	665	672	624	939	940	938	708	715	665	105	106	99
State ...	4,609,769	3,399,580	1,210,189	7,668,356	5,603,123	2,065,233	601	607	586	893	892	895	673	680	655	100	101	97

TABLE 4–24

Estimated Birth Rates by Districts, 1951–60

District		Total	Rural	Urban
Madras	...	34.7	...	34.7
Chingleput	...	37.8	38.5	34.3
North Arcot	...	39.2	40.3	35.4
South Arcot	...	37.1	37.5	35.0
Salem	...	36.4	36.8	35.7
Coimbatore	...	32.2	31.5	34.3
Nilgiris	...	39.6	40.3	38.5
Madurai	...	35.0	34.7	35.4
Tiruchirapalli	...	32.2	32.6	31.5
Thanjavur	...	32.6	33.3	31.5
Ramanathapuram	...	33.6	34.0	32.6
Tirunelveli	...	33.3	34.0	31.9
Kanyakumari	...	36.8	37.1	34.7
State	...	35.0	35.4	34.0

CHAPTER V

MORTALITY TRENDS

Of the three factors influencing population growth, mortality was perhaps the major one which influenced population growth in the past. India had a relatively high birth rate of over 50 per thousand of population in the early decades of the 20th century and international migration was negligible. The growth of population was not uniform in all the decades as could be seen from the following figures.

TABLE 5-1

Percentage variation of population, Madras & India

Decade		Madras	India
1901–1911	...	8.57	5.73
1911–1921	...	3.47	–0.31
1921–1931	...	8.52	11.01
1931–1941	...	11.91	14.22
1941–1951	...	14.66	13.31
1951–1961	...	11.85	21.50

It is evident that the growth of population in the past has been of a sporadic nature. Decades of marked increase have regularly alternated with decades of slight increase. The pattern conforms to the pattern of sporadic growth believed to have existed in the earliest times with the difference that instead of periods of actual declines there are now periods of slight increase. During the last century, war has ceased to be a deterrent factor and in the decades of low growth, the reason can be found in some famine or disease. During the period 1871–81, there occurred the great Indian Famine of 1876–78. Another famine and an influenza epidemic (1918) occurred during 1891–1901 and 1911–21 respectively. The low growth in these decades can be attributed to these calamities, because we find that the provinces and States which are greatly affected by these calamities are exactly those which show the low growth rates. During the other periods which can be regarded as "normal," no widespread catastrophe occurred and the population grew rapidly.

After 1921, the sporadic nature of population growth has ceased abruptly. From 1921–31 the increase of about 11% was the highest on record for India and during the following decade 1931–41, the record was broken by a 14% increase.

The growth of population in 1941–51 was equally rapid with 13% followed by an accelerated growth in 1951–61 with 21.5%. The forty-year period 1921–61 may therefore be regarded as "extremely normal," since these decades have witnessed the highest rates of growth ever recorded in India's demographic history.

In the absence of any evidence regarding changes in fertility, the pattern of growth in various decades suggests the possibility of a decline in death rate, in the last three decades. By far the major evidence concerning the trend in mortality are the registration data which are examined below.

Registration data

Table 5–2 gives the death rate for the period 1921 to 1961 computed from the registration data together with the 5-year and 10-year averages. It is evident from these figures that the death rate has been more or less stable upto 1945 and this has been followed by a rapid decline. Similar returns for the whole of India reveals a decline from 1921. In 1921, the all-India rate stood at 31 per 1,000 inhabitants, but after that time it was never above 30. The average rate for India during the 1911–20 decade was 34 per thousand (or 31 if the deaths in 1918 are removed), as contrasted to 25 during the next decade and 23 during the 1931–40 decade. During the same period, Madras had a death rate of 22 per 1,000 persons. It is evident that Madras has enjoyed a lower death rate than that of India at the beginning of the century and this clearly explains the absence of any visible decline in the period 1921 to 1945. The post-war period is marked by a rapid expansion of medical services and the decline in death rate since 1945 clearly reflects the effect of this expansion.

These rates suffer from considerable under registration. The Population Committee of the Government of India in its report published in 1945 found that under registration of deaths had ranged from 35% in some places to 55% in others. It expressed the view that the average under registration is probably near 50%; when the ages of those dying are taken into account, the range of under registration seems to run from 25 to 65 per cent. When this is the case with India, Madras had a better registration even from the earliest times. Mr. Hutton has made the following observation in the 1931 Census Report for

TABLE 5-2

Death Rates in Madras State, 1921–1960

Year		Total			Rural			Urban		
		Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average
1		2	3	4	5	6	7	8	9	10
1921	...	18.8	...	...	17.6	...	...	25.2	...	...
1922	...	19.6	...	...	18.2	...	...	27.0	...	...
1923	...	20.9	21.0	...	19.9	19.9	...	25.7	27.1	...
1924	...	22.9	...	...	21.8	...	...	28.7	...	...
1925	...	23.0	...	...	21.9	...	...	28.8	...	...
				21.7			20.7			26.7
1926	...	22.5	...	...	21.5	...	...	27.5	...	...
1927	...	21.5	...	...	20.6	...	...	25.5	...	...
1928	...	22.7	22.4	...	21.9	21.6	...	26.9	26.2	...
1929	...	22.8	...	...	22.1	...	...	26.2	...	...
1930	...	22.3	...	...	21.8	...	...	25.1	...	...
1931	...	23.5	...	...	23.2	...	...	24.7	...	...
1932	...	20.9	...	...	20.2	...	...	24.0	...	...
1933	...	21.7	22.4	...	20.9	21.7	...	25.1	25.2	...
1934	...	22.6	...	...	21.9	...	...	25.7	...	...
1935	...	23.2	...	...	22.5	...	...	26.6	...	...
				21.8			21.1			25.0
1936	...	22.3	...	...	21.5	...	...	25.6	...	...
1937	...	21.6	...	...	21.0	...	...	24.7	...	...
1938	...	20.2	21.3	...	19.5	20.5	...	23.5	24.8	...
1939	...	21.0	...	...	20.0	...	...	25.3	...	...
1940	...	21.4	...	...	20.6	...	...	25.0	...	...
1941	...	21.8	...	...	21.0	...	...	25.0	...	...
1942	...	21.5	...	...	21.3	...	...	22.6	...	...
1943	...	25.4	23.1	...	25.0	22.7	...	27.0	24.8	...
1944	...	25.0	...	...	24.5	...	...	26.5	...	...
1945	...	22.0	...	...	21.8	...	...	22.8	...	...
				20.6			20.2			22.3

DEATH RATES IN MADRAS STATE, 1921-60

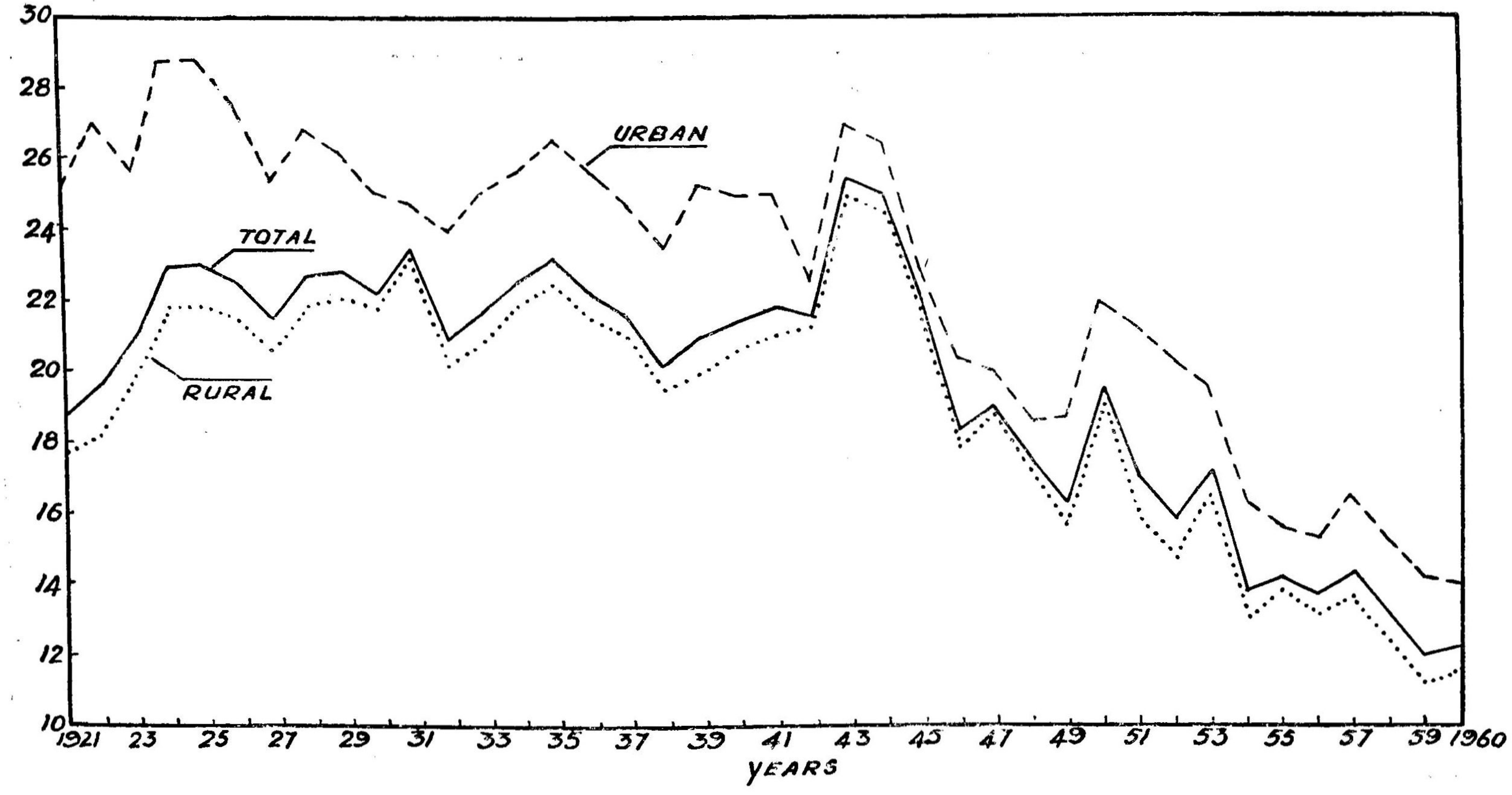


TABLE 5-2—(*Contd.*)

Death Rates in Madras State, 1921-1960—(*Contd.*)

Year		Total			Rural			Urban		
		Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average
1		2	3	4	5	6	7	8	9	10
1946	...	18.3	...	...	17.8	...	...	20.3	...	...
1947	...	19.0	...	...	18.8	...	...	20.0	...	...
1948	...	17.5	18.1	...	17.2	17.7	...	18.6	19.9	...
1949	...	16.3	...	...	15.7	...	...	18.7	...	...
1950	...	19.5	...	...	19.0	...	...	21.9	...	...
1951	...	17.0	...	...	15.7	...	...	21.2	...	...
1952	...	15.9	...	...	14.7	...	...	20.2	...	...
1953	...	17.2	15.6	...	16.5	14.7	...	19.6	18.6	...
1954	...	13.8	...	...	13.0	...	...	16.3	...	...
1955	...	14.2	...	...	13.8	...	...	15.6	...	...
				14.3			13.6			16.8
1956	...	13.7	...	...	13.1	...	...	15.3	...	...
1957	...	14.3	...	...	13.6	...	...	16.4	...	...
1958	...	13.1	13.1	...	12.4	12.4	...	15.2	15.0	...
1959	...	12.0	...	...	11.2	...	...	14.2	...	...
1960	...	12.2	...	...	11.6	...	...	14.0	...	...

India : "The vital statistics of Madras are worthy of reference since this province is the only one whose registration of birth and death approaches anything like a satisfactory standard. The position is more or less the same even today and in our opinion, reliance can be placed on the Madras registration data at least in obtaining a picture of the broad pattern of mortality in the State."

Even if we accept the deficiency in the registration data, there is an unmistakable downward trend in the death rate. Whatever change has occurred in registration is only towards an improvement. Assuming that there has been improvement in registration efficiency, one should expect an increase in the death rate and the clear downward trend in spite of this possibility helps to highlight the decline.

Infant mortality

By infant mortality is meant the deaths occurring to infants before they attain one year and the ratio of infant deaths to thousand live births is known as the infant mortality rate. The registered infant mortality rates, as exhibited in Table 5-3 confirm the above picture of a decline in mortality. In the decade 1921-30, the official infant mortality rate stood at 178 per thousand live births and there is little change in the following decade, the Infant Mortality Rate being 172 during 1931-41. This is followed by a period of steep decline as can be seen from an infant mortality rate of 152 in 1941-51 and 108 in 1951-61. The picture is similar in both rural and urban areas though the figure for urban areas is a trifle higher probably due to better registration.

A comparison of the figures of infant mortality with those for general mortality for India reveals a surprising fact that the percentage decline in infant mortality is much less than the percentage decline in the general mortality. The fall in the infant mortality rate has of course significantly contributed to the reduction in general mortality. Taking 1921 as the base,

TABLE 5-3

Infant Mortality Rates, 1921–1960

Year	Total			Rural			Urban		
	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average
1	2	3	4	5	6	7	8	9	10
1921	160	...	...	...	...	...	...	...	...
1922	178	...	...	...	...	...	...	...	...
1923	176	176	...	...	...	...	...	...	...
1924	177	...	...	...	...	...	...	...	...
1925	189	...	...	...	...	...	...	...	...
			178						
1926	178	...	...	...	...	...	...	...	...
1927	168	...	...	...	...	...	...	...	...
1928	178	180	...	...	...	...	...	...	...
1929	184	...	...	...	...	...	...	...	...
1930	194	...	...	...	...	...	...	...	...
1931	184	...	...	...	...	...	...	...	...
1932	185	...	...	...	...	...	...	...	...
1933	183	182	...	...	...	...	...	...	...
1934	188	...	...	185	...	...	202	...	...
1935	172	...	...	168	...	...	189	...	...
			172						
1936	159	...	...	159	...	...	160	...	...
1937	162	...	...	159	...	...	178	...	...
1938	158	161	...	156	159	...	169	171	...
1939	164	...	...	161	...	...	177	...	...
1940	163	...	...	161	...	...	169	...	...

INFANT MORTALITY RATE IN TOTAL, RURAL AND URBAN POPULATION, 1921-1960

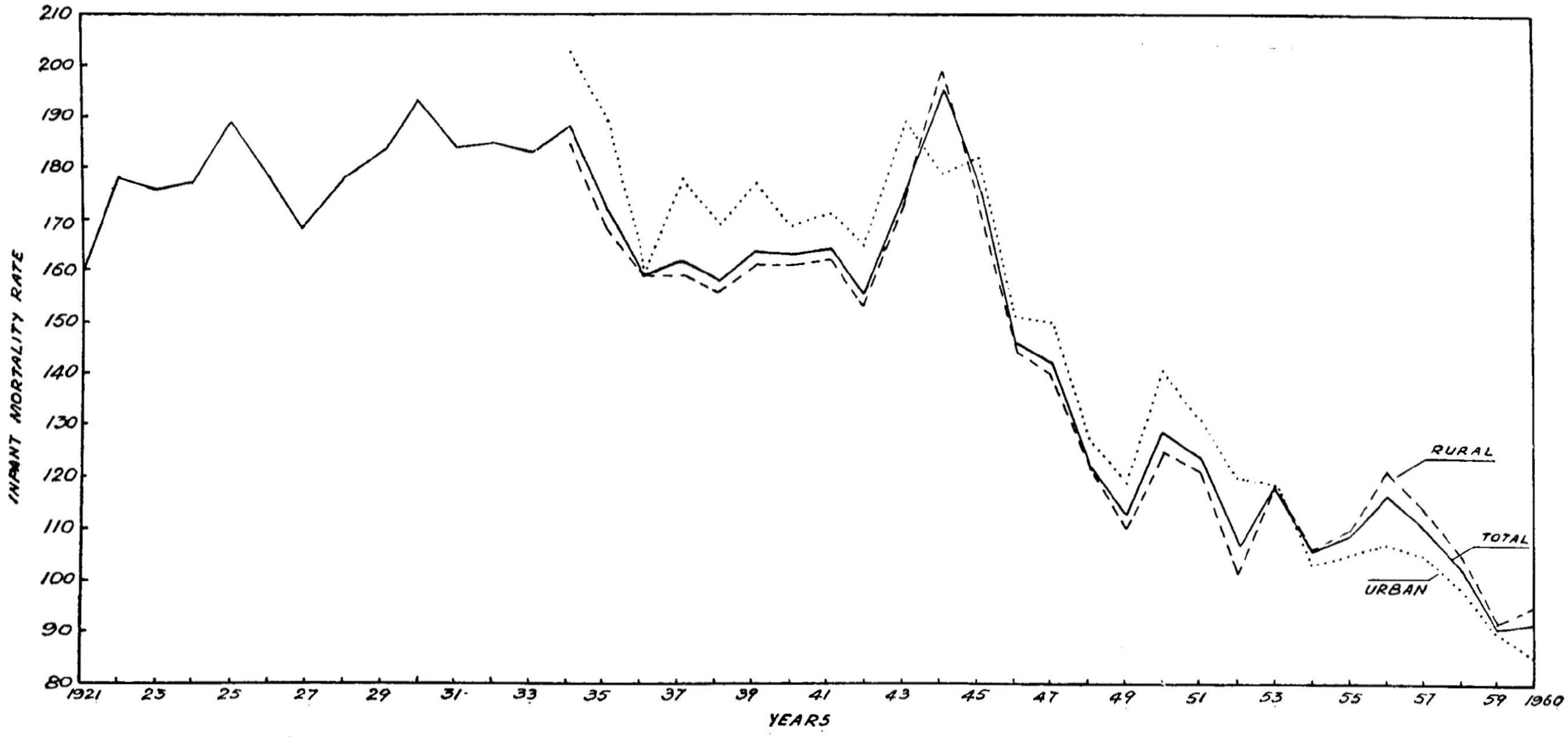


TABLE 5-3—(*Contd.*)

Infant Mortality Rates, 1921–1960—(*Contd.*)

Year		Total			Rural			Urban		
		Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average	Annual rate	5 year average	10 year average
1		2	3	4	5	6	7	8	9	10
1941	...	164	...	...	162	...	...	171	...	...
1942	...	155	...	...	153	...	...	165	...	...
1943	...	176	173	...	173	172	...	189	177	...
1944	...	195	...	...	199	...	...	179	...	...
1945	...	176	...	...	175	...	...	182	...	...
				152			150			157
1946	...	146	...	...	144	...	...	151	...	...
1947	...	142	...	...	140	...	...	150	...	...
1948	...	123	131	...	122	128	...	127	138	...
1949	...	113	...	...	110	...	...	119	...	...
1950	...	129	...	...	125	...	...	141	...	...
1951	...	124	...	...	121	...	...	131	...	...
1952	...	107	...	...	101	...	...	120	...	...
1953	...	119	113	...	119	112	...	119	115	...
1954	...	106	...	...	106	...	...	103	...	...
1955	...	109	...	...	111	...	...	104	...	...
				108			109			106
1956	...	117	...	...	121	...	...	107	...	...
1957	...	111	...	...	114	...	...	105	...	...
1958	...	103	103	...	105	105	...	99	97	...
1959	...	91	...	...	92	...	...	90	...	...
1960	...	92	...	...	95	...	...	85	...	...

we find that the average general mortality for Madras State has increased by 16% upto 1941 but has shown a decrease by 35% by 1961. On the other hand, the infant mortality has increased by only 3% upto 1941 whereas it has declined by 43% upto 1961. This is in striking contrast with that of India as a whole, where the percentage decline in Infant Mortality Rate has not been as high as that of the general mortality rate.

The infant mortality rate suffers from a serious limitation even in countries with good registration system. As the Infant Mortality Rate is a ratio of two entities *viz.*, infant deaths and live births, the extent of accuracy of this rate depends on the extent of accuracy of both infant deaths and live births. Since each one of these is subject to omissions, the registered figures must be recognised as tentative and subject to wide margins of error.

Successive life tables

In the absence of accurate Vital Statistics, census actuaries have placed reliance on age returns of successive Censuses for obtaining a picture of mortality in India and in different regions. There are several limitations in the construction of life tables by this method, but for our purpose they provide an independent evidence of the trends in mortality. These official life tables are available for the South Zone except for the decades 1911–21 and 1931–41 for which official life tables have not been constructed. However, Kingsley Davis has built up the life tables for India for these decades and it will be possible to obtain a picture of mortality for the South Zone. The following table gives the life expectancy at birth and the implied annual death rates obtained from these life tables :

TABLE 5–4

Life expectancy at birth and implied annual death rates

Decade ending	Life expectancy at birth (e°_{0})		Life table death rates ($\frac{1}{e^{\circ}_{0}} \times 1{,}000$)	
	Males	Females	Males	Females
1881 ...	22.35	24.18	44.74	41.36
1891 ...	26.92	27.99	37.15	35.73
1901 ...	26.21	27.13	38.15	36.86
1911 ...	25.92	27.65	38.58	36.17
1921 ...	19.75	24.23	50.63	41.27
1931 ...	28.71	30.04	34.83	33.29
1941 ...	35.03	36.19	28.55	27.63
1951 ...	36.22	37.23	27.61	26.86
1961 ...	41.09	39.24	24.33	25.48

The average expectation of life at birth in the first seven life tables is 26.41 for males and 28.20 for females. In the last two life tables the expectation of life is 38.66 for males and 38.24 for females. This means that during the two decades after the war the expectation of life is nearly 45% higher than in the earlier decades. The average death rate implied by these tables shows the same trend. Thus the life tables, in spite of their limitations seem to reveal the same picture—a picture of declining mortality in recent times.

The proportion of widows

Yet another indication of declining mortality is the proportion of women aged 40 and over who are widowed. Assuming that widow remarriage is negligible (which is of course the case) this would be a good measure of the long run trends in mortality. The following table presents the proportion of widows among women aged 40 and over :

TABLE 5–5

Percentage of widows among women aged 40 and over

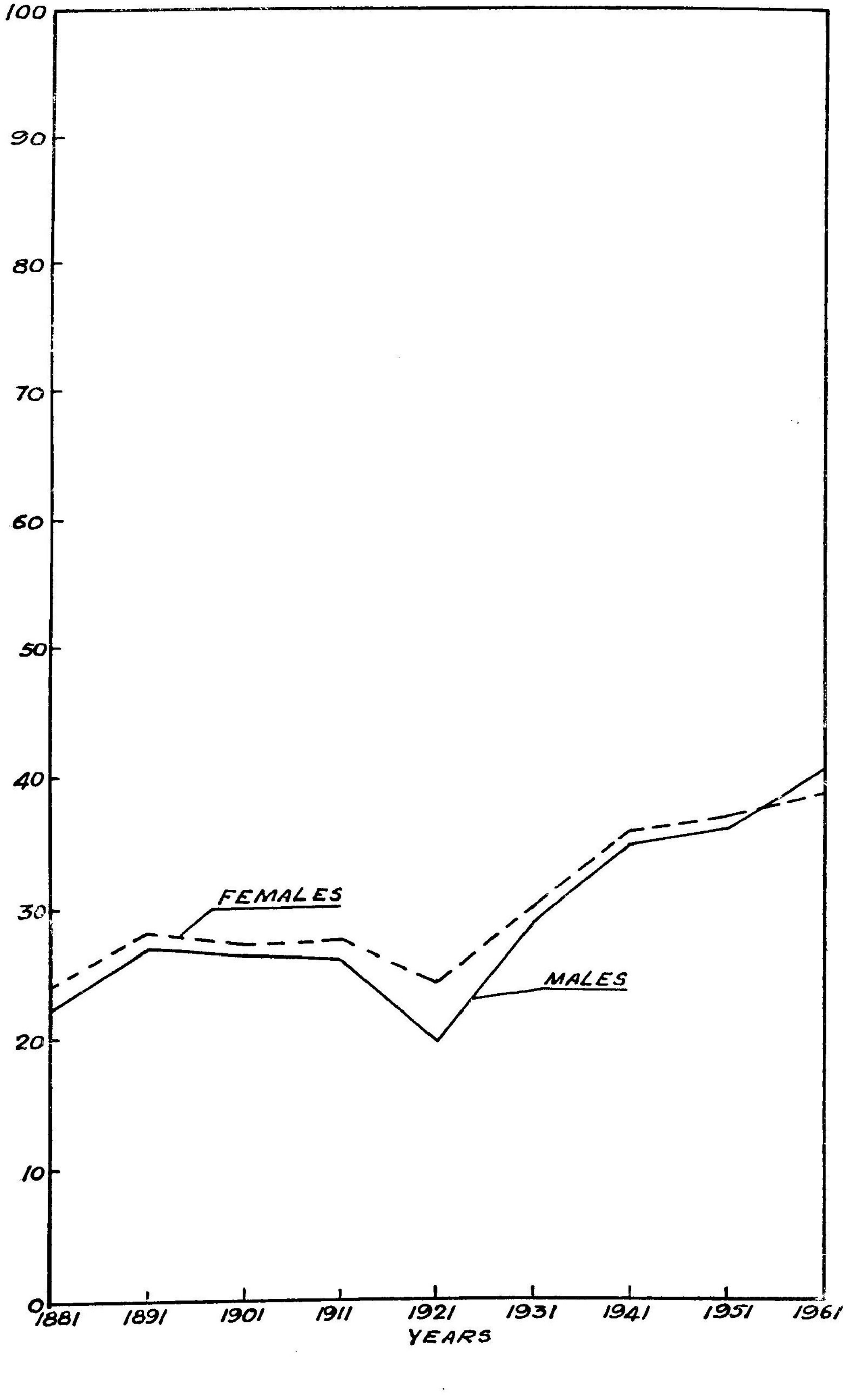
1901	...	61.0
1911	...	58.0
1921	...	57.4
1931	...	59.7
1951	...	48.9
1961	...	49.4

It is seen that prior to 1951 nearly 60% of women aged 40 and over were widows. This proportion has steeply gone down to a bare 50% during the decades 1931–51 and is more or less stationary at that level since then. In fact, the period 1931–51 has been the period of marked expansion of medical services in the State and the decline in the proportion of widows during this period can be attributed to the improvement in public health and a consequent reduction in mortality.

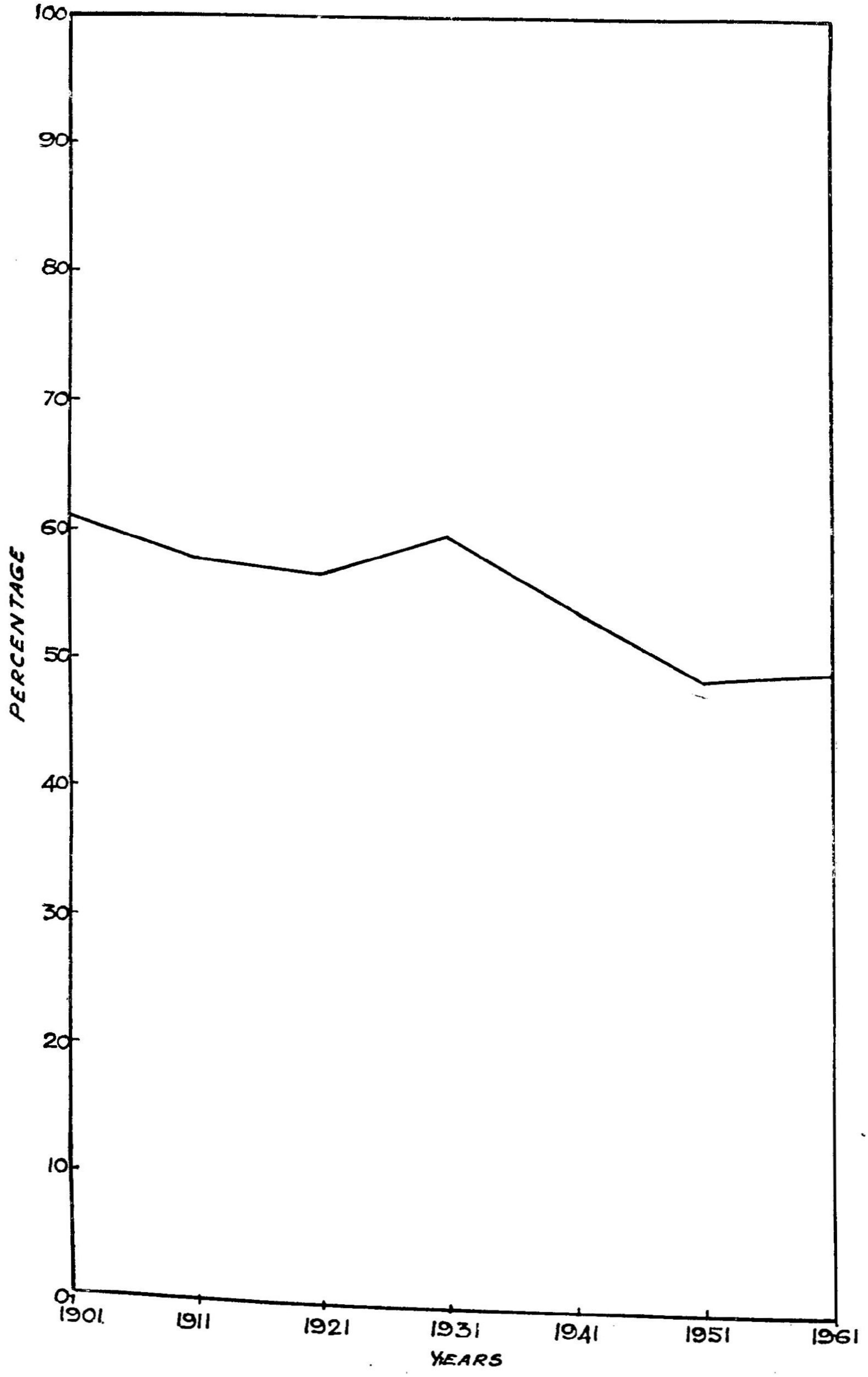
Causes of the declining death rate

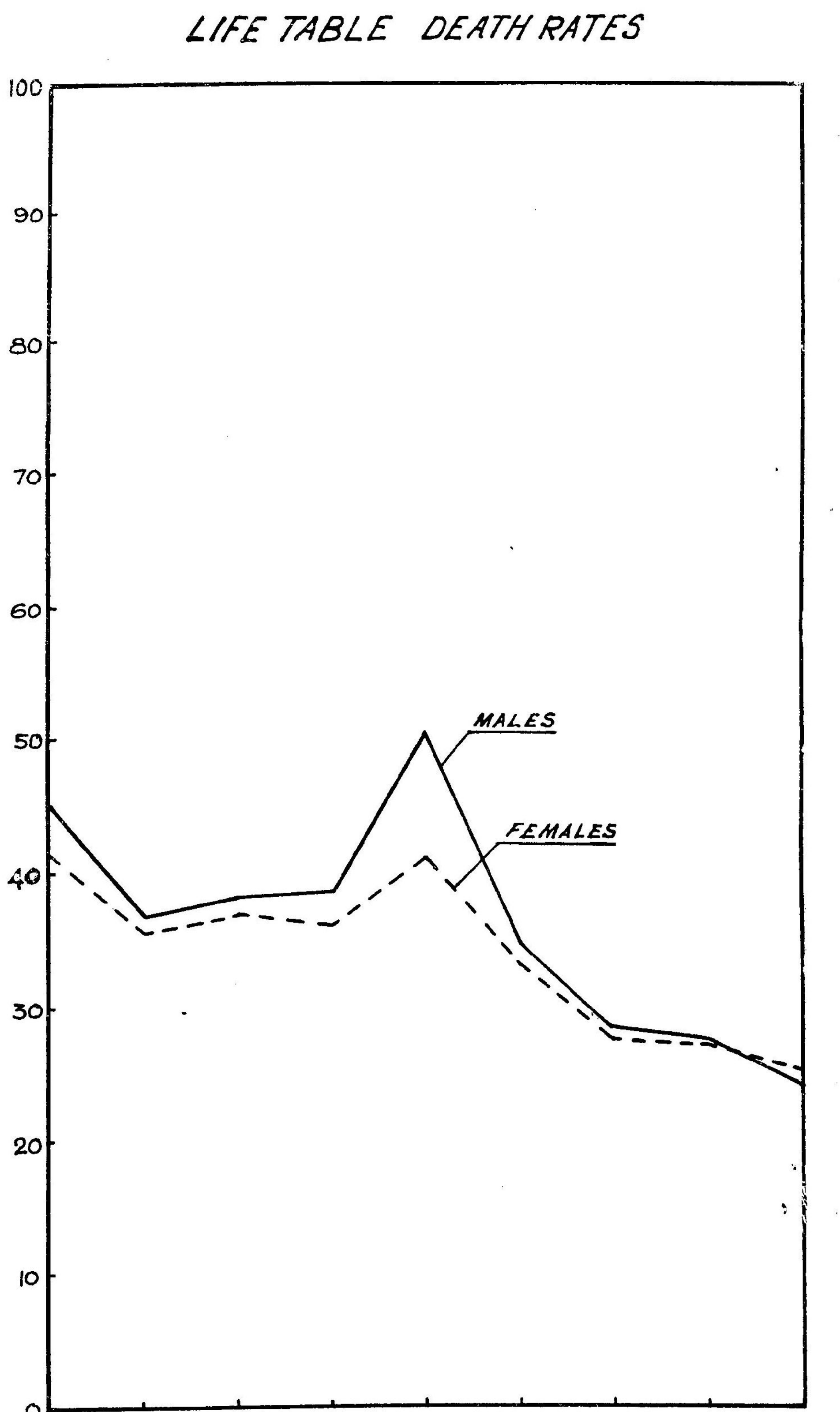
It is difficult to compress the reasons for the fall in death rate in a short canvas since several factors like medical, economic, political and social are at work in the society bringing about a reduction in the death rate. In the initial stages the gains were small, but in due course particularly after the war the decline of mortality has been quite rapid.

LIFE EXPECTANCY AT BIRTH

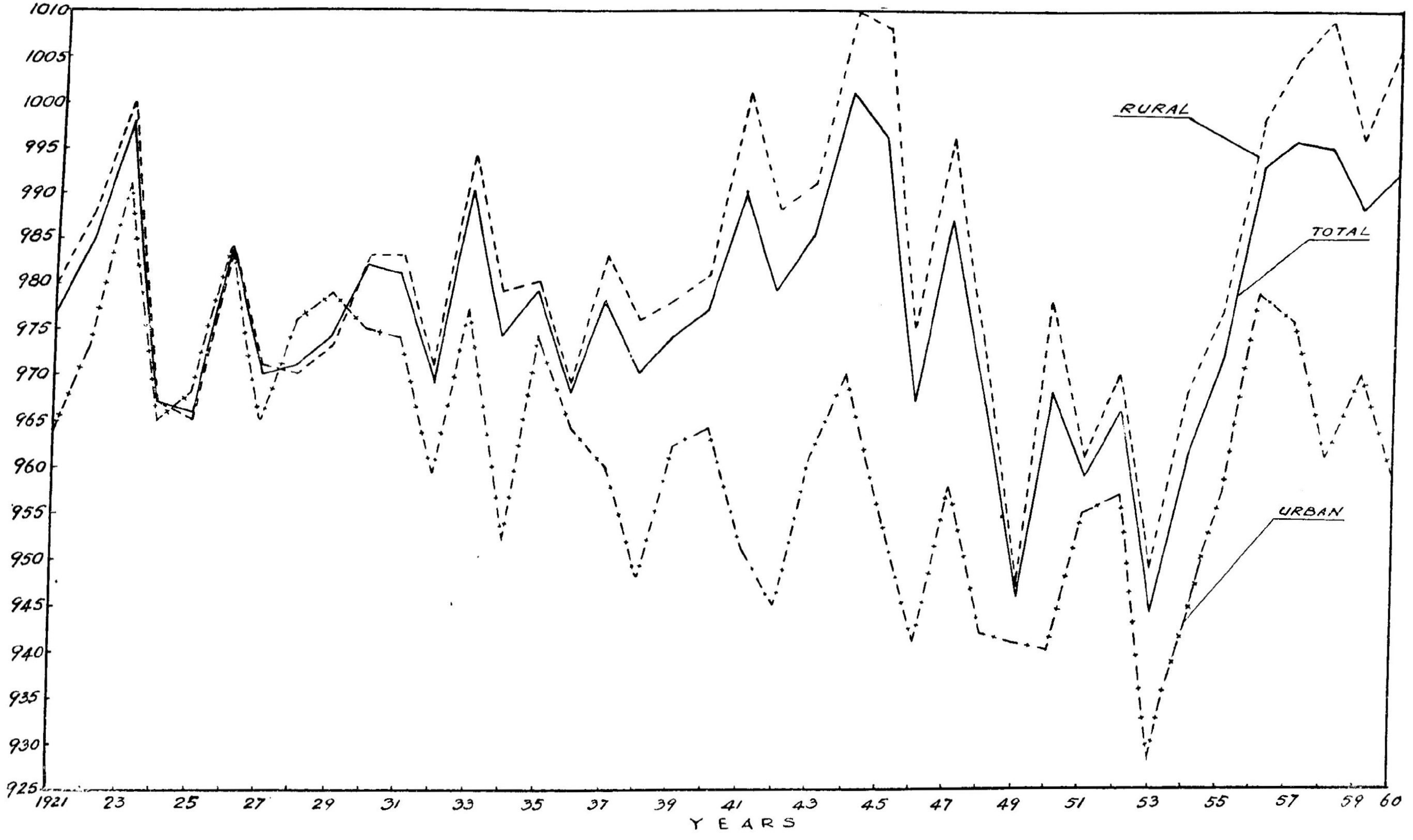


PERCENTAGE OF WIDOWS AMONG WOMEN AGED 40&OVER.




LIFE TABLE DEATH RATES
100
90
80
70
60
50
40
30
20
10
0
MALES
FEMALES
1881
1891
1901
1911
1921
1931
1941
1951
1961
YEARS

SEX-RATIO AMONG DEATHS (FEMALES PER 1,000 MALES)



Unlike the rest of the country, Madras has been having a fairly stable administration during the last two hundred years and the law and order situation has been good. There are no organised gangs like the Thugs and Pindars of the North to cause destruction of life and property in this State. Therefore, war and banditry (one of the Malthusian remedies of population pressure) were relatively absent in this State and hence, we cannot regard their elimination as a major factor for the decline of mortality in the State.

The demographic history of Madras State is marked by lulls and spurts in population growth, mostly influenced by fluctuations in the death rate. If in some years it had remained stagnant or even declined, it was due to some great catastrophe such as famine or epidemic and if in some years the population had grown, it was because of the relative absence of these scourges. Broadly speaking, there were three checks to population growth in the past *viz.*, (1) famines including famine diseases, (2) epidemic diseases and (3) endemic diseases. Mr. J. T. Marten in his report of the 1921 Census of India has pointed out, " In an agricultural country famine is merely one of the recognised extremes in the obvious relation between population and food. Epidemics such as malaria, the disease of waste places and cholera seem to be bound up with the climatic and physical conditions of the country and are familiar in every degree of intensity. Even plague is recognized as a disease of congested areas and has a close connection with the aggregation of population. Influenza, however, seems periodically to thrust itself, an unwelcome exotic in the picture of Indian life and represents an unknown quantity which is equally fatal in the jungle and in the city and has no certainty of origin, no measure of intensity and no regional limitation."

Control of famine

Earliest references to famines in India are found in the Rig Veda. In the third book of the Rig Veda, a prayer is offered to " drive poverty and famine far from us" while in hymn 53 of the same book, the danger of famine having been dispelled is mentioned. A similar prayer is offered in hymn 55, Book VIII where Indra is invoked to keep people free from famine. Among other books of the earlier times which contain reference to famine mention may be made of Nirukta by Yaska (Ch. II, Sec. II), belonging to the late Vedic period, Ramayana, (Balmik, Ch. 9, Verses 9 & 10) Jataka Stories of Buddhists (Jataka XXII) and Chanakya's Arthasastra.

It is often said that famines are rooted to the geography of the Indian soil. The rainfall in India has been highly seasonal and scanty in many areas, and its irregularity is responsible for both droughts as well as floods. Failure of rainfall cannot be regarded as a cause for famines, but there are other factors which lead to this condition. Agriculture is the mainstay of India and the poor transportation, excessive dependence on land and lack of irrigation facilities add to distress conditions arising from a failure of rainfall. These conditions are just as important as geographic factors in explaining Indian famines. In fact these factors are more important since these are the factors amenable to control in any attempt to eliminate or control famines.

Famines and Scarcities in India (1801 to 1908)

Year		Parts of the country affected
1799–1801 to 1802–04	...	N. W. Provinces, Bombay, Central India and Rajputana.
1806–07	...	Widespread, especially Carnatic.
1812	...	Bombay, Agra and Madras.
1819–20	...	N. W. Provinces, Rajputana, Deccan and Broach.
1820	...	Upper Sind.
1822	...	Upper Sind.
1824–25	...	Bombay (Deccan). Also in Deccan District of Madras.
1832–33	...	Sholapur (Bombay) and Northern Madras.
1833–34	...	Gujarat, Khandesh, N. Deccan and Parts of N. W. P.
1837–38	...	N. W. P., Punjab and Rajputana.
1853–55	...	Madras, Bombay and Rajputana.
1860–61	...	N. W. P., Punjab, Rajputana and Kutch.
1862	...	Deccan.
1866–67	...	Orissa, Bengal and Bihar.
1868–69	...	N. W. P., Punjab and Rajputana.
1873–74	...	Bengal, Bihar and Bundelkhand.
1876	...	Scarcity in Bengal.
1876–78	...	Madras, Bombay, Mysore and Hyderabad.
1877–78	...	N. W. P., Kashmir and Punjab.
1879–80	...	Deccan.
1880	...	N. W. P.
1884–85	...	Bengal.
1886–87	...	Central Provinces.
1888–89	...	Ganjam (Madras), Orissa.
1890–92	...	Local scarcities in Garhwal, Almorah, Bengal, Bihar, Madras and Ajmer Marwara.

Famines and Scarcities in India (1801 to 1908)—*(Contd.)*

Year		Parts of the country affected
1894	...	Central Provinces.
1896–97	...	N. W. P. & Oudh, Bengal, Madras, Central Provinces, Bombay, Punjab and several Indian States.
1899–1900	...	Central Provinces, Berar, Bombay, Punjab and Ajmer.
1905–06	...	Bombay.
1906–07	...	North Bihar.
1907–08	...	Severe in United Provinces, Central Provinces, Madras, Bengal and Bombay slightly affected.

(*Source* : **B. M. Bhatia—Famines in India, 1963**).

It is impossible to gauge the exact amount of mortality caused by famines. Many famines occurred before vital statistics were even attempted, and those occurring since then still fall in a period when vital statistics data are deficient. The registration system, furthermore, tends to break down under famine conditions, so that even lesser number of deaths are recorded than in ordinary years. One very crude method of finding the effect of famines is to compare the growth during the decades when famines occurred and during the decades when famines did not occur.

The Report of the Famine Commission of 1880 has pointed out that " except in Burma and the most eastern parts of Bengal, where the rain has never been known to fail, and in Sind in which the population is wholly dependent on river irrigation, hardly any other part of Indian empire has escaped the visitation of severe famine during the last century, and that over considerable portions acute distress has recurred frequently. Taking all the 21 famines and scarcities recorded in the last 109 years in any part of India, the proportion is 24 years of bad seasons to 85 years of good, or about 2 bad seasons to 7 good ; in each case on an average, one-fifth of the population of the whole country, that is about 20 millions, may be approximately taken as the portion affected, so that the result might be said to be equivalent to a famine or scarcity over the whole country once in 54 years. Of these calamities, 8 may be classed as intense famines, 9 as famines and 4 as severe scarcities. Omitting severe scarcities, there have been 17 famines, affecting 20 years and occurring at an average interval of 5 years. There have been eight greater famines, affecting 11 years, and occurring at intervals which have varied from 2 or 3 to 40 years and which average 12 years. Of these, five have occurred in the present century and have affected 202 millions of people, so that each on an average has been felt by 40 millions, or one-sixth of the population of India." The Census Report of 1891 has made a reference to serious failure of crops in the erstwhile Madras State in 1889, but the direct effects of this were comparatively small. The All-India Census Report of 1901 mentions about the scarcity in 1891–92 in considerable areas of Madras State and in 1896 there were sudden famines in several States including Madras. It is relevant to quote the reference about Madras here : " The decline of population between 1871 and 1881 was due to the calamitous famine of 1876–78 and was far greater than would appear from a comparison of the Census figures, which are estimated to have been deficient in 1871 to the extent of nearly 850,000." Since 1850 the conditions in Madras have not been favourable to a rapid increase of the population. According to Mr. Francis, " Plague checked trade and enterprise and there were three scarcities—in 1891–92, in 1897 and in 1900. The first of these was most severely felt in the Deccan districts especially in the Cumbum and Markapur taluks of Kurnool and in the adjoining western taluks of Nellore. The second affected the Deccan Division again, and the Ganjam, Vizagapatam, and Godavari Districts of the East Coast Division. The third was again worst in the Deccan (especially in Cuddapah) and the western part of Nellore and also attacked the west part of adjoining Kistna. What the precise effect of each of these visitations was, it is not easy to say. The Sanitary Commissioner concluded that though no actual deaths from starvation were reported during the scarcity of 1897, the total diminution of population due to the famine conditions which then prevailed, such as reduced birth rate, increased susceptibility to ordinary disease among ill-nourished persons and so on was over 200,000 persons. Most of this loss was estimated to have occurred in the Deccan districts." It may be added that the above famines were less severe in Madras than in many other parts of India. The worst was that of 1896–97 ; but thanks to the prompt measures of relief undertaken by the Madras Government and the previous four years of plenty, the sufferings of the people were far less than they would otherwise have been. Mr. J. A. Baines has made the following observations in the 1891 Census Report for India. " As regards the first the number of people who die from actual want of food is probably small when compared to the deaths which result from the greater hold which disease gets on those who are enfeebled by diminution of their usual supply of nutriment. Thus in times of scarcity, the mortality from ordinary causes, such as bowel complaints and intermittent fever rises considerably above the normal rate since many succumb who would in ordinary times offer a successful resistance. The second

of the results just mentioned was very prominent in the age returns at the Census of 1881 for the Deccan and Southern India, and reappears at the age of 10 to 14 in those of 1891. From these data it is clear that famine is most felt in the first four or five years of life. It then seems to pass lightly over the adults and to fix on the aged but only where the distress is acute for the evidence on this point is not conclusive, as it is on the other. Now as the reproductive ages are the least affected, one would expect to find the process of replenishing the gaps in the depleted population in full operation within a year of the return of normal prosperity. But even when the famine was followed by a bumper harvest this did not happen and the cause of the check in reproduction was undoubtedly physical weakness, resulting from the long spell of insufficient nourishment endured by the masses. It took from three to four years, according to the returns to restore the vitality of the worst tracts . . . . There is also an indication that the resistance offered to distress is greater on the part of females than of males. On the whole, we have only to read of the terrible mortality that accompanied the historic famines of 100 or 150 years ago to appreciate the advance that has been made within the present generation in administrative experience of how to deal with these calamities, so that their effects may be mitigated, though to prevent them is unpracticable. But the aid of lines of railway and telegraph, the tract threatened with scarcity is brought into speedy communication with those in which the harvest has been abundant, so that from the latter food pours in as long as the prices at the markets of the former keep the transport remunerative. The case of the classes thrown out of work by a failure of the crops who have neither grain of their own nor cash in hard to buy what is physically within their reach, has been duly considered and so far as a crisis of this sort is concerned, the problem of State aid to the unemployed has been solved. An estimate based on local enquiry, collated with census returns of caste and occupation is prescribed for each district, showing the approximate numbers of the community that are most prone to suffer, classified according to the order in which they are respectively likely to be thrown upon State support. Estimates and plans of undertakings of public utility involving the employment of the requisite number of unskilled labour are kept in readiness by the Public Works Branch of the Local Government, and by each of the latter a code of rules regarding famine administration has been framed, which includes minutiae of sanitary arrangements, daily tasks, the laying out of camps of work and refuge with other measures of relief that the experience of the last 30 years has proved to be the most efficient in the circumstances of the tract and population to which they are to be made applicable.'

The All-India Census Report for 1921 has recorded the following about conditions in Madras State. "There was a general failure of the south-western monsoon and a consequent contraction of the area under cultivation, the deficiency being most striking in the Deccan, where dry cultivation was 78% and wet cultivation 73% below the average of the previous five years. The situation was rendered worse by the delay in the north-west monsoon and cropped area fell in one year by nearly three million acres. The tracts worst affected were the East-Coast (North) and the Deccan divisions and the districts of Chittoor and Salem. In the Ganjam district there was severe distress over more than 1,000 square miles and the numbers in receipt of daily relief rose to over 150,000 in October, 1919."

The following conclusions suggest themselves from the foregoing discussion. Famine was a major check to population growth in the past but even when it was most severe, Madras State was comparatively less afflicted when compared to the rest of India. Almost all the tracts of recurrent famine—the circars and Rayalaseema areas of the former Madras State have since joined the Andhra State and the present Madras State is comparatively free from these famine tracts. Secondly, considerable progress has been made in the measures of preventing famine during the last half a century or more and this was due to the realisation of the seriousness of the problem by the government and the initiation of adequate measures. Shri R. A. Gopalaswami has made the following observations in his 1951 Census Report: "Even during 1891–1900 when the first of these checks *viz.*, famines, including famine diseases were at their height, human intelligence was already devising and perfecting the counter checks by which the natural checks could be prevented from operating. These counter-checks comprised: First, the creation of conditions in which the development of agricultural production would be both possible and profitable and take place of its own accord; secondly the development of transport and communications (so as to open up all areas liable to scarcity and famine and thereby ensure the availability of commercial supplies of foodgrains); and thirdly, the organisation of efficient administrative arrangements for provision of employment and wages to the landless rural people in those places and at those times when prolonged and severe drought occurred and they were unemployed and without purchasing power."

The control of epidemic diseases

Next to famine as a widespread killer in the Indian sub-continent, rank epidemic diseases. Just like

famine its seriousness is not confined to the number of deaths caused but also in its unexpectedness, virulence, and its consequences. It is much more desirable to have a population where birth and death rates are stable or steadily growing rather than subject to year to year spurts and lulls, but unfortunately this was what was wanting in the eighteenth and nineteenth century India. The influenza epidemic of 1918 more than doubled the regular mortality rate in India. According to Kingsley Davis the epidemic took a toll of 16 million lives and killed 5% of the population.[1] During the same period the mortality in Madras State has been estimated to be of the order of one million or 5% of the total population.[2] Added to this, there was widespread sickness which left a major section of the population in a physically weakened condition. In the 1891 Census Report, Mr. Baines has made the following observation:

"Cholera and Small-pox are the two main causes of abnormal mortality in India, apart from famine and certain special outbreaks of fever, which will be noticed below. Not a year passes without Cholera in some part or another of the country and there seems to be no sign of its becoming rarer or less fatal. Whatever may be its origin, its dissemination is no doubt largely due to the immense congregation of pilgrims at certain seasons of the year, especially about the hottest time, to bathe and drink at one of many sacred rivers or pools of the country, just about the month when the water is at its lowest. In spite of all the sanitary precautions adopted the outbreak is still a matter of chance, and once it happens there is no limit to its local extension. As to small-pox, though it cannot be said to have been stopped by the greater prevalence of vaccination nowadays, it is said to be of a milder type in some parts of the country where it was formerly frequent and severe.

Fever as has just been remarked, includes a variety of diseases, and influenza, in the form in which it is prevalent during the past three years. There are however certain classes of fever that seem confined to special localities, which they ravage for a few years, and often disappear as unexpectedly as they broke out. For instance in the Brahmaputra Valley of Assam, the "black sickness" (Kala Azar) that broke out some years since has been peculiarly destructive to life along the southern bank, and has also crept across to a few tracts on the northern. For some time it baffled medical research, but its native was thoroughly investigated in 1890 by a competent expert, who found the disease to be largely due to insanitary habits of the villagers."

It will be of interest to recall the following account of an epidemic. During an epidemic it is said, "Life goes on as usual in the neighbourhood and funeral processions wending their way almost unnoticed to the burial ground and the burning ghat may be the only indication of the tragedies of the epidemic. During severe epidemics some measures of hardships result from the temporary failure of the food supply, the disruption of trade, the interference with agriculture and the interruption of traffic ; but even the most virulent pestilence is short-lived and these ill-effects disappear with astonishing rapidity and with them all the memory of the epidemic."[3]

These epidemics have two possible effects on the population of India. (1) It provides a relief to the population pressure in the country by taking away the excess of population. (2) The attack of the epidemics being mostly on the young and the old dependants, fewer dependants are left to be supported by the working people. Thus there is a rise in the standard of living of those who are left alive after the scourge. It appears that these famines and epidemics seemed to be beneficial in some way to the population. Kingsley Davis has put forth a theory why India should be a home of epidemics. In most communities according to him epidemics have occurred only in the periods when several communities have come into contact with each other and likewise the epidemics in India are the results of the breakdown of India's medieval stagnation. According to this theory, there is a natural process of immunisation taking place even today and there are quite a few epidemics not yet experienced in India such as yellow fever which may sometime ravage the population. Fortunately, we have the benefits of the scientific medicine which have been successful in combating epidemics in the West and the adoption of which do not involve far reaching social changes. A discussion of a few diseases like Cholera, Small-pox and Plague attempted in this chapter will clearly show how the increasing control of mortality in India has been achieved during the last half a century or more. Before going into these details, it is useful to evaluate the 'cause of death' statistics available from vital registration.

[1] Kingsley Davis : 'The Population of India and Pakistan,' p. 41.

[2] K. E. Vaidyanathan : A Demographic Study of Madras State, a dessertation submitted at the Demographic Training & Research Centre, Bombay, 1961.

[3] C. A. Gill : "Epidemics", Encycloepaedia of the Social Sciences, Vol. V, New York, p. 571.

Cause of death statistics

Cause of death particulars are available in the vital statistics returns for municipal and non-municipal areas. For municipal areas a return of births and deaths furnished every week under the District Municipalities Act of 1920 provides for deaths of either sex due to following causes :—

1. Cholera,
2. Small-pox,
3. Measles,
4. Plague,
5. Typhoid or enteric fever,
6. Fevers :
   (*a*) Relapsing fever,
   (*b*) Kala Azar,
   (*c*) Malaria,
   (*d*) Influenza,
   (*e*) Other fevers,
7. Respiratory diseases :
   (*a*) Pneumonia,
   (*b*) Phthisis (consumption),
   (*c*) Other respiratory diseases,
8. Alimentary System :
   (*a*) Dysentery,
   (*b*) Diarrhoea,
9. Deaths due to child birth,
10. Injuries :
    (*a*) Suicides,
    (*b*) Wounds & accidents,
    (*c*) Snake bites & killed by wild beasts,
    (*d*) Rabies,
11. All other causes,
12. Total deaths.

These particulars are to be provided for each religion in Form D submitted by the municipalities every week end. Provision exists in the above form for furnishing the particulars of small-pox deaths in greater detail, *viz.*, for children under 1 year, children from 1 to 10 years and children above 10 years. Apart from this weekly return each municipality prepares a monthly return which presents deaths from each cause by age groups. The classification adopted in the monthly return of the municipalities is as follows :—

1. Infectious diseases :
   (*a*) Cholera,
   (*b*) Plague,
   (*c*) Small-pox,
   (*d*) Measles,
   (*e*) Chicken-pox,
   (*f*) Typhoid or enteric fever,
   (*g*) Diptheria,
   (*h*) Others.
2. Fevers :
   (*a*) Malaria,
   (*b*) Influenza,
   (*c*) Relapsing fever,
   (*d*) Kala Azar,
   (*e*) Rheumatic fever,
   (*f*) Other fevers.
3. Respiratory diseases :
   (*a*) Tuberculosis of lungs,
   (*b*) Pneumonia,
   (*c*) Others.
4. Alimentary system :
   (*a*) Dysentery,
   (*b*) Diarrhoea,
   (*c*) Others.
5. Diseases of the liver :
   (*a*) Cirrhosis,
   (*b*) Others.
6. Circulatory system :
   (*a*) Heart disease,
   (*b*) Arterio scierosis,
   (*c*) Others.
7. Genito-urinary diseases excluding venereal diseases :
   (*a*) Brights' disease,
   (*b*) Others.
8. Venereal diseases :
   (*a*) Syphillis,
   (*b*) Gonorrhoea,
   (*c*) Others.
9. Diseases of the nervous system :
   (*a*) Convulsions,
   (*b*) Cerebral haemorrhage (apoplexy).

(*c*) Tetanus,
(*d*) Epilepsy,
(*e*) Others.

10. Accidents of pregnancy and child birth :
    (*a*) Puerperal Sepsis,
    (*b*) Abortion,
    (*c*) Other accidents and diseases of pregnancy and parturition.
11. Deficiency Diseases :
    (*a*) Beriberi,
    (*b*) Rickets,
    (*c*) Others.
12. Malignant Diseases :
    (*a*) Alimentary tract,
    (*b*) Genito urinary,
    (*c*) Breast,
    (*d*) Other regions.
13. Ankylostomiasis.
14. Diabetes.
15. Leprosy.
16. Alcoholism.
17. Congenital debility and malformation, premature birth.
18. Rabies.
19. Wounds and accidents.
20. Snake-bite.
21. Killed by wild beasts.
22. Suicides.
23. Poisons.
24. Old age.
25. All other causes.
26. Total deaths from all causes.

These particulars are furnished for the following age categories :

1. Under one year :
    (*a*) Under one week,
    (*b*) Over one week and not exceeding one month,
    (*c*) Over one month and not exceeding 6 months,
    (*d*) Over 6 months and not exceeding 12 months,
    (*e*) Total under one year.
2. Over one year and under 5 years.
3. Over five years and under 10 years.
4. Over 10 years and under 15 years.
5. Over 15 years and under 20 years.
6. Over 20 years and under 30 years.
7. Over 30 years and under 40 years.
8. Over 40 years and under 50 years.
9. Over 50 years and under 60 years.
10. 60 years and above.
11. Total of all ages.

In August, 1919, Government of India decided that a supplementary statement should be prepared regarding the death due to various causes and the preparation of the statement should be optional for the whole or part of the province. In Madras State the statement of optional deaths are compiled for the Municipalities in respect of the following causes :

1. Malaria
2. Enteric fever
3. Measles
4. Relapsing fever
5. Kala Azar
6. Influenza
7. Dysentery
8. Diarrhoea
9. Pneumonia
10. Pulmonary Tuberculosis
11. Dipthcria
12. Cerebro spinal fever
13. Deaths from child birth
14. Infant death.

In the rural areas where Act III of 1899 is in force, the following classes of deaths are recorded :—

1. Cholera
2. Small-pox
3. Plague
4. Relapsing fever
5. Malaria fever
6. Other fever
7. Dysentery and Diarrhoea
8. Respiratory diseases
9. *Injuries* :
    (*a*) Suicides
    (*b*) Wounds and Accidents
    (*c*) Snake-bite
    (*d*) Killed by Wild Beast
    (*e*) Rabies
    (*f*) Deaths from child birth
10. All other causes.

TABLE 5–6

Deaths due to Cholera, Small-pox and Plague, 1921–60

Year		Cholera			Small-pox			Plague		
		Annual death	5 year average	10 year average	Annual death	5 year average	10 year average	Annual death	5 year average	10 year average
1		2	3	4	5	6	7	8	9	10
1921	...	12,170	...	...	4,165	...	...	11,187	...	...
1922	...	3,507	...	...	15,441	...	...	7,977	...	...
1923	...	3,265	20,352	...	12,654	10,002	...	10,870	7,090	...
1924	...	39,678	...	...	8,924	...	...	3,710	...	...
1925	...	43,138	...	...	8,825	...	...	1,708	...	...
				21,139			7,450			4,136
1926	...	23,036	...	...	6,053	...	...	1,386	...	...
1927	...	22,836	...	...	4,140	...	...	1,099	...	...
1928	...	33,435	21,926	...	3,977	4,899	...	1,246	1,181	...
1929	...	23,532	...	...	5,925	...	...	1,075	...	...
1930	...	6,792	...	...	4,400	...	...	1,097	...	...
1931	...	24,974	...	...	3,188	...	...	1,028	...	...
1932	...	4,788	...	...	4,676	...	...	1,352	...	...
1933	...	777	14,673	...	8,158	6,095	...	1,005	954	...
1934	...	11,520	...	...	7,392	...	...	1,103	...	...
1935	...	31,304	...	...	7,060	...	...	283	...	...
				12,529			4,129			764
1936	...	28,430	...	...	2,442	...	...	255	...	...
1937	...	17,554	...	...	1,727	...	...	1,015	...	...
1938	...	3,990	10,385	...	1,771	2,164	...	1,062	574	...
1939	...	1,837	...	...	2,380	...	...	295	...	...
1940	...	112	...	...	2,498	...	...	245	...	...

TABLE 5-6—(Contd.)

Deaths due to Cholera, Small-pox and Plague, 1921-60—(Contd.)

Year		Cholera			Small-pox			Plague		
		Annual death	5 year average	10 year average	Annual death	5 year average	10 year average	Annual death	5 year average	10 year average
1		2	3	4	5	6	7	8	9	10
1941	...	120	...	...	906	...	...	165	...	...
1942	...	30,703	...	...	2,081	...	...	2,374	...	...
1943	...	71,156	22,584	...	3,100	5,783	...	4,692	2,007	...
1944	...	10,029	...	...	10,675	...	...	1,403	...	...
1945	...	914	...	...	12,152	...	...	1,402	...	...
				18,032			4,389			1,490
1946	...	172	...	...	3,042	...	...	1,992	...	...
1947	...	11,217	...	...	1,399	...	...	2,249	...	...
1948	...	20,254	13,479	...	1,908	2,996	...	539	972	...
1949	...	9,409	...	...	1,550	...	...	76	...	...
1950	...	26,341	...	...	7,079	...	...	3	...	...
1951	...	12,692	...	...	8,003	...	...	3	...	...
1952	...	9,081	...	...	2,385	...	...	4	...	...
1953	...	16,517	8,031	...	2,588	2,998	...	6	4	...
1954	...	1,575	...	...	1,409	...	...	6	...	...
1955	...	291	...	...	606	...	...	...	...	...
				4,563			2,948			4
1956	...	6	...	...	1,129	...	...	1	...	...
1957	...	2,930	...	...	3,893	...	...	1	...	...
1958	...	2,312	1,095	...	5,498	2,898	...	...	5	...
1959	...	206	...	...	2,225	...	...	7	...	...
1960	...	20	...	...	1,744	...	...	14	...	...

TABLE 5-7

Deaths as per detailed causes in Municipal Towns with a population of 30,000 and above having Health Officers

Sl. No.	Causes	1956	1957	1958	1959	1960
1	2	3	4	5	6	7
	Infectious diseases					
1	Cholera	...	308	288	3	5
2	Plague	...	...	...	...	...
3	Small-pox	169	905	412	251	725
4	Measles	75	62	22	27	22
5	Chicken-pox	7	22	17	3	6
6	Typhoid or Enteric fever	431	399	394	284	456
7	Diphtheria	220	208	233	210	298
8	Others	23	37	7	7	104
	Fevers					
9	Malaria	191	142	88	79	58
10	Influenza	34	43	4	7	10
11	Relapsing fever	1	...	1	...	...
12	Kala Azar	2	...	1	2	11
13	Rheumatic fever	18	17	33	14	25
14	Other fevers	2,433	3,080	3,085	3,189	5,177
	Respiratory Diseases					
15	Tuberculosis of lungs	2,442	2,402	2,081	2,145	2,613
16	Phneumonia	4,564	4,656	3,695	3,219	6,573
17	Others	2,310	2,546	2,534	2,275	6,627
	Alimentary Diseases					
18	Dysentery	2,507	3,152	2,876	2,559	5,387
19	Diarrhoea	2,244	2,431	2,213	1,885	3,865
20	Others	1,045	1,165	1,124	879	1,580

TABLE 5-7—(*Contd.*)

Deaths as per detailed causes in Municipal Towns with a population of 30,000 and above having Health Officers (*Contd.*)

Sl. No.	Causes	1956	1957	1958	1959	1960
1	2	3	4	5	6	7
	Diseases of the Liver					
21	Cirrhosis	764	755	712	604	918
22	Others	391	453	436	378	469
	Circulatory System					
23	Heart Disease	1,602	1,749	1,614	1,820	2,441
24	Arterio-Sclerosis	10	9	18	19	60
25	Others	1,376	1,467	1,514	1,325	2,077
	Genito-Urinary Diseases					
26	Bright's Diseases	572	678	622	456	593
27	Others	341	273	201	203	592
	Venereal Diseases					
28	Syphilis	14	20	11	22	20
29	Gonorrhoea	54	118	5	1	14
30	Others	17	27	11	13	33
	Diseases of the Nervous System					
31	Convulsions	4,265	4,749	4,065	3,977	4,337
32	Cerebro Haemorrhage (Apoplexy) ...	82	161	97	117	159
33	Tetanus	450	430	454	523	716
34	Epilepsy	58	79	92	131	112
35	Others	839	1,027	944	912	1,726
	Accident of pregnancy and Child Birth					
36	Puerperal Sepsis	235	210	184	143	184
37	Abortion	101	90	77	95	92
38	Other Accidents and Diseases of Pregnancy and Parturition ...	647	732	600	688	683

TABLE 5-7—(*Contd.*)

Deaths as per detailed causes in Municipal Towns with a population of 30,000 and above having Health Officers—(*Contd.*)

Sl. No.	Causes	1956	1957	1958	1959	1960
1	2	3	4	5	6	7
	Deficiency diseases					
39	Beri-Beri	8	2	14	10	5
40	Rickets	253	175	158	164	189
41	Others	724	555	479	508	1,009
	Malignant diseases					
42	Alimentary Tract	50	40	44	36	95
43	Genito urinary	15	15	9	13	53
44	Breast	10	3	7	2	5
45	Other regions	155	164	157	165	515
46	Ankylostomiasis	38	9	33	30	24
47	Diabetes	253	220	213	247	312
48	Leprosy	85	88	62	66	113
49	Alcoholism	3	4	...	1	...
50	Congenital debility and Malformation, Premature Birth	4,925	4,710	4,572	4,747	7,186
51	Rabies	82	75	88	86	163
52	Wounds and accidents	847	863	886	861	1,142
53	Snake-bite and Scorpion sting, etc. ...	23	38	47	45	61
54	Killed by wild beasts	...	...	...	...	1
55	Suicides	158	117	122	159	295
56	Poisons	74	73	60	99	249
57	Old Age	7,199	8,370	7,643	7,271	11,834
58	All other causes	5,207	6,031	5,858	6,985	11,601
59	Total deaths from all causes ...	50,643	56,154	51,217	49,960	83,620

TABLE 5-8

Deaths in Rural and Urban Areas of Madras State, 1956-61 Monthwise

Year	January	February	March	April	May	June	July	August	September	October	November	December	Total
							RURAL						
1956 ...	29,791	27,450	25,820	24,441	24,538	23,498	25,260	26,319	23,923	23,296	28,382	32,937	315,655
1957 ...	28,265	22,816	22,173	22,475	22,621	29,467	35,477	29,115	25,789	25,370	29,302	36,400	329,270
1958 ...	33,623	26,507	24,446	22,341	23,346	25,038	24,339	23,980	23,477	25,052	25,712	27,139	305,000
1959 ...	24,976	20,742	22,042	20,188	21,640	22,370	25,441	24,318	21,755	20,821	24,857	28,677	277,827
1960 ...	27,236	23,463	21,128	20,628	21,444	21,195	21,356	22,761	21,824	24,077	29,525	35,338	289,975
1961 ...	33,772	30,107	29,015	25,013	24,574	25,015	27,619	26,486	24,306	24,973	27,325	29,575	327,780
Total ...	177,663	151,085	144,624	135,086	138,163	146,583	159,492	152,979	141,074	143,589	165,103	190,066	1,845,507
Average No. of deaths in each month ...	29,611	25,181	24,104	22,514	23,027	24,431	26,582	25,497	23,512	23,932	27,517	31,677	307,585
Percentage to total deaths ...	9.6	8.2	7.8	7.3	7.5	7.9	8.7	8.3	7.7	7.8	8.9	10.3	...
							URBAN						
1956 ...	10,788	10,709	10,031	9,103	9,303	8,889	9,753	9,730	8,963	9,131	10,920	12,683	120,003
1957 ...	11,054	9,772	9,993	9,352	10,158	13,042	11,885	10,586	10,746	9,931	10,753	14,280	131,552
1958 ...	12,961	10,774	9,930	9,324	9,795	9,703	10,042	9,040	9,946	10,359	10,056	12,391	124,321
1959 ...	10,231	9,296	9,399	8,965	9,611	9,169	10,409	10,122	9,093	8,135	10,440	13,052	117,922
1960 ...	10,297	10,505	9,659	8,735	9,471	8,908	8,528	9,402	8,222	9,828	10,818	14,113	118,486
1961 ...	11,289	10,510	10,634	9,705	9,571	9,170	10,184	9,888	9,140	8,909	9,509	11,449	119,958
Total ...	66,620	61,566	59,646	55,184	57,909	58,881	60,801	58,768	56,110	56,293	62,496	77,968	732,242
Average No. of deaths in each month ...	11,103	10,261	9,941	9,197	9,651	9,813	10,134	9,795	9,352	9,382	10,416	12,995	122,040
Percentage to total deaths ...	9.1	8.4	8.2	7.5	7.9	8.0	8.3	8.0	7.7	7.7	8.5	10.7	...

The Public Health Act, 1939 defines the following diseases as infectious diseases :—

(*a*) acute influenzal pneumonia

(*b*) anthrax

(*c*) cerebro spinal fever

(*d*) chicken-pox

(*e*) cholera

(*f*) diptheria

(*g*) enteric fever

(*h*) leprosy

(*i*) measles

(*j*) plague

(*k*) rabies

(*l*) relapsing fever

(*m*) scarlet fever

(*n*) small-pox

(*o*) tuberculosis

(*p*) typhus

Apart from these, Government may include any other disease as an infectious disease. The local authorities are expected by this Act to provide adequate staff, hospital facilities, etc., in the event of occurrence of any of these infectious diseases. In the same Act, the following diseases have been declared as notified infectious diseases :

(*a*) cerebro spinal fever

(*b*) chicken-pox

(*c*) cholera

(*d*) diptheria

(*e*) leprosy

(*f*) measles

(*g*) plague

(*h*) rabies

(*i*) scarlet fever

(*j*) small-pox

(*k*) typhus

Government may declare any other disease as a notifiable disease. Government have given enormous powers to the Health Officer or Sanitary Inspector in the municipal areas and the Health Inspector or village headman in non-municipal areas to control notifiable diseases.

Comments on cause of death statistics

The defects in the cause of death statistics directly flow from the defect of the agency responsible for the registration. The man who reports death and who is probably making the diagnosis is the village headman. First and foremost he has to do this work in the midst of his other preoccupations with revenue work and he has little time to bestow on vital registration. Secondly, in most of the villages the village headman is illiterate and he can hardly be expected to diagnose the cause of death of a person who is already dead. Quite often he reports 'fever' or 'not known' whenever he has a doubt.

It is relevant to recall the remark of A. J. H. Russel, the Director of Public Health for Madras State in 1922. "Although it is impracticable to have a scientifically accurate classification of the causes of mortality with the present agency responsible for registration, the obvious absurdities of noting "fevers," under "diarrhoea," ascribing child birth as cause of death among men and children, mentioning "still born" cases as so many days or months old and so forth, might easily be avoided. In Madurai town, in Mettupalayam, and in Poonamallee, the last mentioned error seems to be particularly common. There is also a tendency on the part of many registrars to classify "small-pox" under "other causes," "fever" or "measles," and to register "cholera" as "diarrhoea" or dysentery. The concealment of diseases like small-pox, cholera and plague has in many instances permitted the occurrence of severe epidemics which might possibly have been averted if the cases, especially those which occurred at the beginning, had been correctly registered and promptly reported."

Table 5-9 gives a picture of the deaths due to various causes in the Madras State.

Cholera, small-pox and plague account for only one per cent of deaths in 1956-60. Fevers other than malaria are responsible for 15%, dysentery and diarrhoea for 8% and respiratory diseases for 10%. The residuary group "all other causes" was responsible for 64% of the total deaths. In the present set up for registration of births and deaths in rural areas where the village headmen are the registrars of births and deaths it is inevitable that the residuary group should loom large as contrasted with the vital statistics published in advanced western countries. If any public health programme is to be launched to reduce the mortality

TABLE 5-9

Deaths and death rates* by causes, 1956-60

Causes	1956		1957		1958		1959		1960	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
Cholera ...	6	0.02	2,930	9.06	2,312	7.07	206	0.62	20	0.06
Small-pox ...	1,129	3.53	3,893	12.04	5,498	16.82	2,225	6.73	1,744	5.22
Plague ...	1	0.003	1	0.003	...	...	7	0.02	14	0.04
Malaria ...	1,603	5.01	969	3.00	1,229	3.76	732	2.21	637	1.91
Fevers other than malaria	66,244	207.24	72,267	223.56	64,491	197.28	57,572	174.14	59,982	179.40
Dysentery & diarrhoea ...	33,006	103.25	35,401	109.51	34,406	105.25	29,033	87.82	31,739	94.93
Respiratory diseases ...	44,221	138.34	46,978	145.33	42,258	129.27	40,856	123.58	40,612	121.46
Injuries ...	6,152	19.25	6,251	19.34	6,818	20.86	6,772	20.48	6,659	19.92
All other causes ...	284,279	889.33	292,132	903.71	272,309	832.98	258,346	781.43	267,054	798.72
Total ...	436,641	1,365.97	460,822	1,425.55	429,321	1,313.28	395,749	1,197.04	408,461	1,221.65

in the State, it is very imperative that this area should be particularly investigated.

The figures of optional deaths available for municipality are presented in Table 5-10 along with the total deaths for these municipalities. Here the figures for 1951-55 do not include the figures for Kanyakumari district and Shencottah taluk of Tirunelveli District for which similar particulars were not compiled for earlier years. However, to obtain a broad picture of the magnitude of the operation of these specific causes this table is very useful.

"Pneumonia" accounts for the largest number of deaths (7.39%) reported under the optional clause. "Other respiration diseases" account for 6.95% of the total deaths in municipalities in 1956-60 and dysentery falls next with 6.28%. Another important disease causing death is diarrhoea which accounts for over 5.09% of the deaths in municipal areas. Infant deaths constitute 24.51% of the deaths in municipal areas and maternal deaths another 1.19%. The contribution of malaria, enteric fever, measles, relapsing fever, diptheria, cerebro spinal fever, kala azar and influenza is relatively negligible. Death registration is better in the municipal areas when compared to the non-municipal areas since the general educational standard of the public as well as the registration officials is better in municipal areas than in non-municipal areas. The Health Officers, Sanitary Inspectors and other health staff in position in municipalities are more competent than the village headman in identifying each of the causes. We can therefore place greater reliance on the cause of death statistics of municipal areas than for the other areas.

A fairly good picture of the causes of mortality statistics, and the detailed causes of deaths in municipalities with a population of 30,000 and above and having Health Officers is given in Table 5-7. This table clearly shows that convulsions, malformation and premature births, pneumonia, congenital debility, dysentery and unspecified fevers were the important causes of deaths and were responsible for over 50% of the deaths recorded in these municipal towns. Old age has been responsible for nearly one seventh of the total deaths.

* Rates per lakh of persons.

TABLE 5-10

Optional deaths from certain causes in the Municipal Areas, 1951-60 *

Causes	1951	1952	1953	1954	1955	1951-55 No.	1951-55 Percentage	1956	1957	1958	1959	1960	1956-60 No.	1956-60 Percentage
1. Malaria ...	532	352	389	326	319	1,918	0.37	250	181	106	96	67	700	0.15
2. Enteric fever ...	981	927	896	841	768	4,413	0.85	698	707	671	490	544	3,110	0.65
3. Measles ...	202	80	36	94	89	501	0.10	80	85	46	48	26	285	0.06
4. Relapsing fever	18	2	8	...	...	28	0.01	4	1	...	...	...	5	0.001
5. Kala azar ...	4	4	...	4	2	14	0.003	2	12	11	10	3	38	0.01
6. Influenza ...	60	44	48	56	58	266	0.05	42	83	12	9	15	161	0.03
7. Dysentery ...	7,384	7,628	6,823	4,910	5,681	32,426	6.26	5,521	6,316	6,243	6,118	5,938	30,136	6.28
8. Diarrhoea ...	4,847	5,462	5,277	4,508	4,758	24,852	4.80	5,570	5,543	4,759	4,174	4,370	24,416	5.09
9. Pneumonia ...	6,135	7,937	5,161	4,756	4,752	28,741	5.55	5,024	10,124	8,569	8,244	3,467	35,428	7.39
10. Other respiratory diseases...	13,249	10,902	12,550	3,169	10,662	50,532	9.76	10,499	11,660	11,183	...	...	33,342	6.95
11. Pulmonary tuberculosis ...	4,576	4,201	4,034	3,276	3,180	19,267	3.72	3,098	3,256	2,918	3,067	2,865	15,204	3.17
12. Diphtheria ...	123	203	187	236	214	963	0.19	243	301	336	300	268	1,448	0·30
13. Gerebro spinal fever ...	28	17	6	18	33	102	0.02	61	32	24	39	56	212	0.04
14. Deaths from child-birth ...	1,233	1,175	1,009	1,157	1,205	5,779	1.16	1,256	1,195	1,055	1,166	1,021	5,693	1.19
15. Deaths under one year ...	24,519	24,117	22,309	20,435	23,166	114,546	22.11	24,165	24,144	23,905	23,126	22,233	117,573	24.51
Deaths from all causes ...	113,574	109,257	111,644	92,711	90,820	518,006	...	92,844	102,406	97,196	93,131	94,125	479,702	...

* Items 1 to 15 do not add to the total.

The Madras Corporation has compiled the cause of death statistics for Madras City for 1960-62 according to the International Standard classification. The figures under the 17 broad causes are given in Table 5–11.

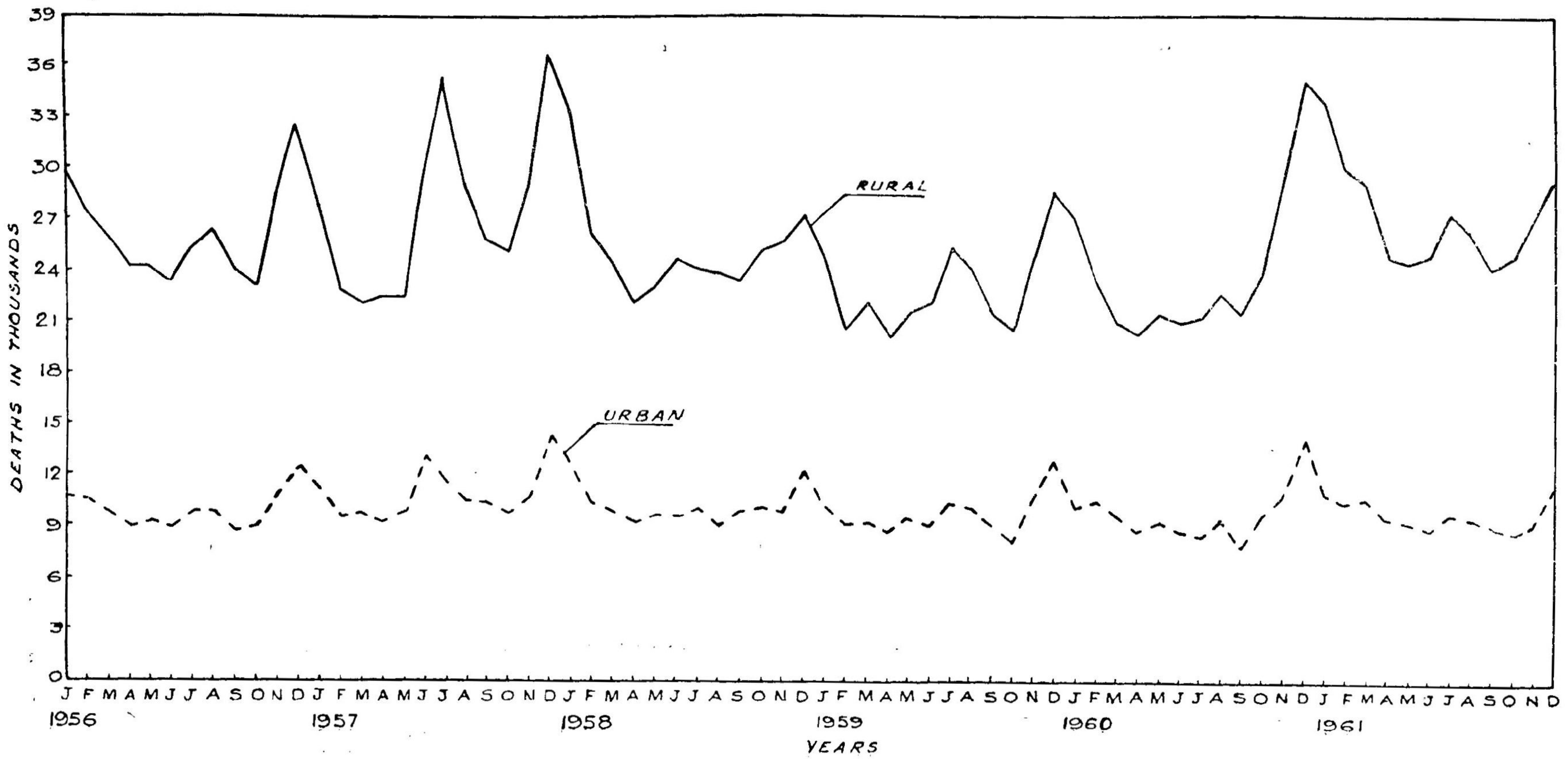
TABLE 5–11

Deaths by broad causes—Madras City, 1960–62

Causes	1960		1961		1962	
	Males	Females	Males	Females	Males	Females
1. Infective and Parasitic diseases ...	2,548	2,243	2,654	2,603	1,782	1,678
2. Neoplasms	146	145	141	130	105	143
3. Allergic, endocrine system, metabolic and nutritional diseases ...	255	250	196	185	152	144
4. Diseases of the blood and blood forming organs	127	194	163	216	118	152
5. Mental, Psychoneurotic and personality disorders	3	4	11	13	3	3
6. Diseases of the nervous system and sense organs	515	467	516	396	412	340
7. Diseases of the circulatory system ...	990	578	928	554	1,113	612
8. Diseases of the respiratory system ...	4,024	3,927	3,462	3,444	3,146	3,113
9. Diseases of the digestive system ...	2,019	1,796	1,795	1,723	1,463	1,379
10. Diseases of the genito-urinary system...	307	249	242	245	213	223
11. Delivenis and complications of pregnancy, child-birth and the puerperium	...	119	...	83	...	124
12. Diseases of the skin and cellular tissue...	9	11	15	18	19	18
13. Diseases of the bones and organs of movement	20	16	13	17	21	17
14. Congenital malformations ...	64	73	86	85	89	56
15. Certain diseases of early infancy ...	1,473	1,264	1,527	1,277	1,311	1,046
16. Symptoms, senility and ill defined conditions	4,359	4,923	4,464	4,718	4,421	4,872
17. Accidents, poisonings and violence ...	319	255	340	234	283	204
Total ...	17,178	16,514	16,553	15,941	14,651	14,124

Of the 17 broad causes considered here, we find that the largest percentage of deaths (29.2%) is due to symptoms, senility and ill defined conditions (No. 16). Next come the diseases of the respiratory system which account for 22.2% of deaths in the City during 1960–62. Infective and parasitic diseases and diseases of the digestive system account for 14.2% and 10.7% respectively. Certain diseases of early infancy have contributed to 8.3% of the deaths in the City during 1960–62. The contributions of the remaining groups are relatively small. If we go into the detailed classification, we find that pneumonia, senility without psychosis, other diseases of the respiratory system account for the largest number of deaths. Deaths due to different diseases during the years 1956 to 1960 are given districtwise, separately for rural and urban areas in the Appendix.

MONTHWISE DEATHS IN RURAL AND URBAN AREAS, 1956 TO 1961



Seasonal variations in mortality

To study the seasonal variations in mortality the number of deaths in each month during the five year period 1956–61 has been plotted in a graph separately for rural and urban areas. There are up and down fluctuations in the number of deaths, but it is striking that December and January seem to have more than the average quota of deaths. An index of seasonality has been worked out for each month by expressing the average deaths in each month as a percentage to the average annual deaths. The figures are presented in Table 5–8. It appears that November, December and January have more than the average number of deaths in a month. The remaining months have the average or below average number of deaths. The reasons for the shooting up of the mortality curve in November, December and January can be traced only by analysing the seasonality of each of the individual causes of deaths. This will be attempted in a later chapter.

Mortality differentials by religion

An attempt has been made to compile the data on religious differentials in mortality from the registration data. Table 5–12 summarises the death and death rates by religion for the period 1956–60 for which figures are available for the present Madras State.

TABLE 5–12

Death and Death Rates by Religion, Madras State, 1956–60

Year	Hindu		Muslim		Christian	
	No.	Rate	No.	Rate	No.	Rate
1956 ...	398,456	13.9	17,569	11.7	18.045	11.4
1957 ...	422,723	14.5	18,903	12.5	17,346	10.7
1958 ...	391,384	13.3	18,463	12.1	17,781	10.7
1959 ...	361,199	12.2	16,988	11.0	16,074	9.5
1960 ...	374,478	12.5	16,402	10.6	15,871	9.2

We find a consistent pattern of higher death rates for Hindus when compared to Muslims who are themselves having a higher death rate than the Christians. Assuming that the efficiency of registration is the same in the three communities, this seems to indicate a higher mortality among Hindus when compared to Muslims and Christians. If we examine the districtwise pattern, all the districts except Madras City reveal the same picture. In Madras City, the death rate among Muslims is the highest, followed by Hindus and Christians have the lowest death rate. The death rate of Muslims has ranged from 23 to 29 in 1956–1961 whereas that of Hindus from 20 to 23. A similar pattern has existed even in earlier years and it is difficult to explain the reasons for the higher death rate for Muslims in the City while they have a lower death rate in the rest of the State.

Mortality in slum and non-slum areas

The Slum Survey conducted by this department in 1961 has revealed a higher mortality in slum areas when compared to the non-slum areas in 10 selected divisions of Madras City. The data were collected from the Corporation divisional offices where slum data are maintained and with the help of a list of areas notified by the Corporation of Madras as slum, the figures for slum and non-slum areas were separated. The figures are given in Table 5–13.

TABLE 5–13

Deaths and infant death rates in slum and non-slum areas of Madras City

Sl. No.	Division No.	Name of Division	Death Rate		Infant Death Rate	
			Slum Area	Non-slum Area	Slum Area	Non-slum Area
1	8	Royapuram ...	24	13	122	51
2	13	Muthialpet ...	17	15	138	93
3	43	Agaram ...	14	9	85	58
4	51	Shenoynagar ...	17	10	120	84
5	52	Kilpauk ...	17	15	123	53
6	56	Thousand Lights..	17	12	102	85
7	85	Santhome ...	22	10	110	95
8	88	Alwarpet ...	19	16	139	68
9	90	Adyar ...	16	12	125	52
10	95	Rajaji Nagar ...	23	10	149	94
		Total ...	18	12	124	73

It is seen that the crude death rate is 50% higher in the slum areas than in the non-slum areas whereas the infant mortality rate is 70% higher in slum areas. It was also found that the birth rate in the slum areas was 43% higher than the non-slum areas. The picture that emerges from the above discussion is a grim one—a picture of promiscuity, low health and a higher fatality to diseases. If we consider the fact that nearly one-fifth of the City's population live in slum areas, this is only indicative of a dangerous portent unless the population of slum areas can be instilled with a zeal for a less promiscuous, healthy and clean life. The need of the hour seems to be a reform similar to the one brought by Edwin Chadwick in England in the wake of the industrial revolution.

TABLE 5–14

Death rate in the State of Madras according to age groups—1951-55

Age groups	1951		1952		1953		1954		1955		Average 1951–55	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
1	2	3	4	5	6	7	8	9	10	11	12	13
Under 1 year *	130.1	122.1	111.3	105.1	125.8	116.3	112.1	101.7	115.6	104.9	119.0	110.0
1— 4 ...	27.8	27.1	27.6	27.0	25.5	24.7	23.1	23.6	23.4	23.7	25.5	25.2
5— 9 ...	5.9	5.7	5.1	5.1	6.0	5.9	4.9	4.9	4.3	4.2	5.2	5.2
10—14 ...	4.3	4.8	3.2	3.7	4.0	4.3	2.9	3.1	3.7	4.0	3.6	4.0
15—19 ...	6.6	7.7	5.9	6.8	6.4	7.5	4.5	5.6	6.6	7.5	6.0	7.0
20—29 ...	5.9	6.7	4.9	6.0	5.7	6.6	4.0	5.1	3.8	5.0	4.9	5.9
30—39 ...	8.4	9.0	7.3	8.0	9.0	9.5	6.3	6.9	6.6	7.7	7.5	8.2
40—49 ...	14.6	12.5	12.6	10.6	14.5	12.1	10.4	8.9	10.8	9.8	12.6	10.8
50—59 ...	20.6	17.5	19.5	17.0	24.2	19.8	17.4	14.4	15.2	13.0	19.4	16.3
60+ ...	76.1	73.3	75.2	73.3	85.1	80.8	62.7	60.3	57.6	57.4	71.3	69.0
All ages ...	17.7	16.9	16.6	15.9	18.1	17.0	14.3	13.7	14.8	14.4	16.3	15.6

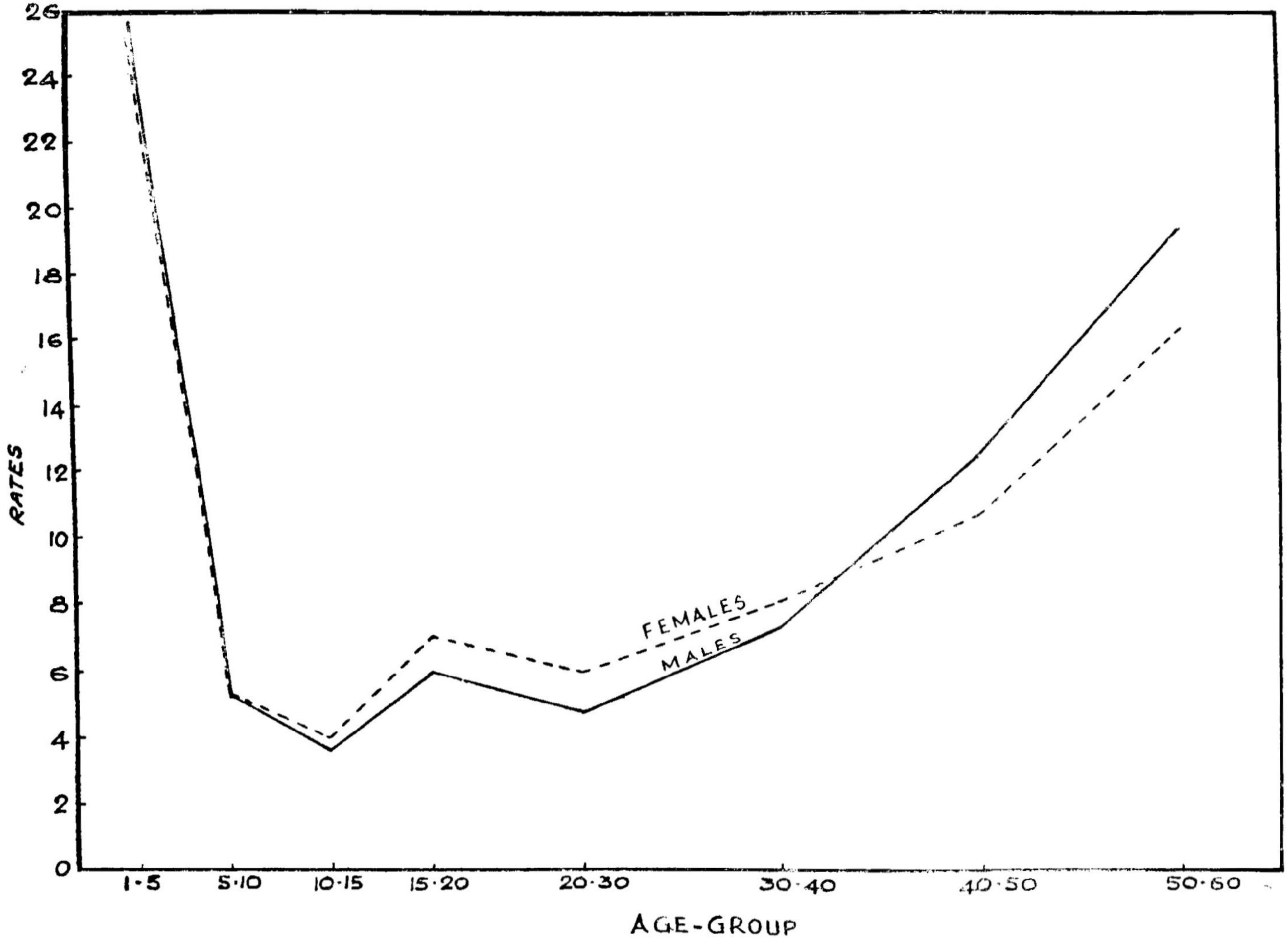
TABLE 5–15

Death rate in the State of Madras according to age groups—1956-60

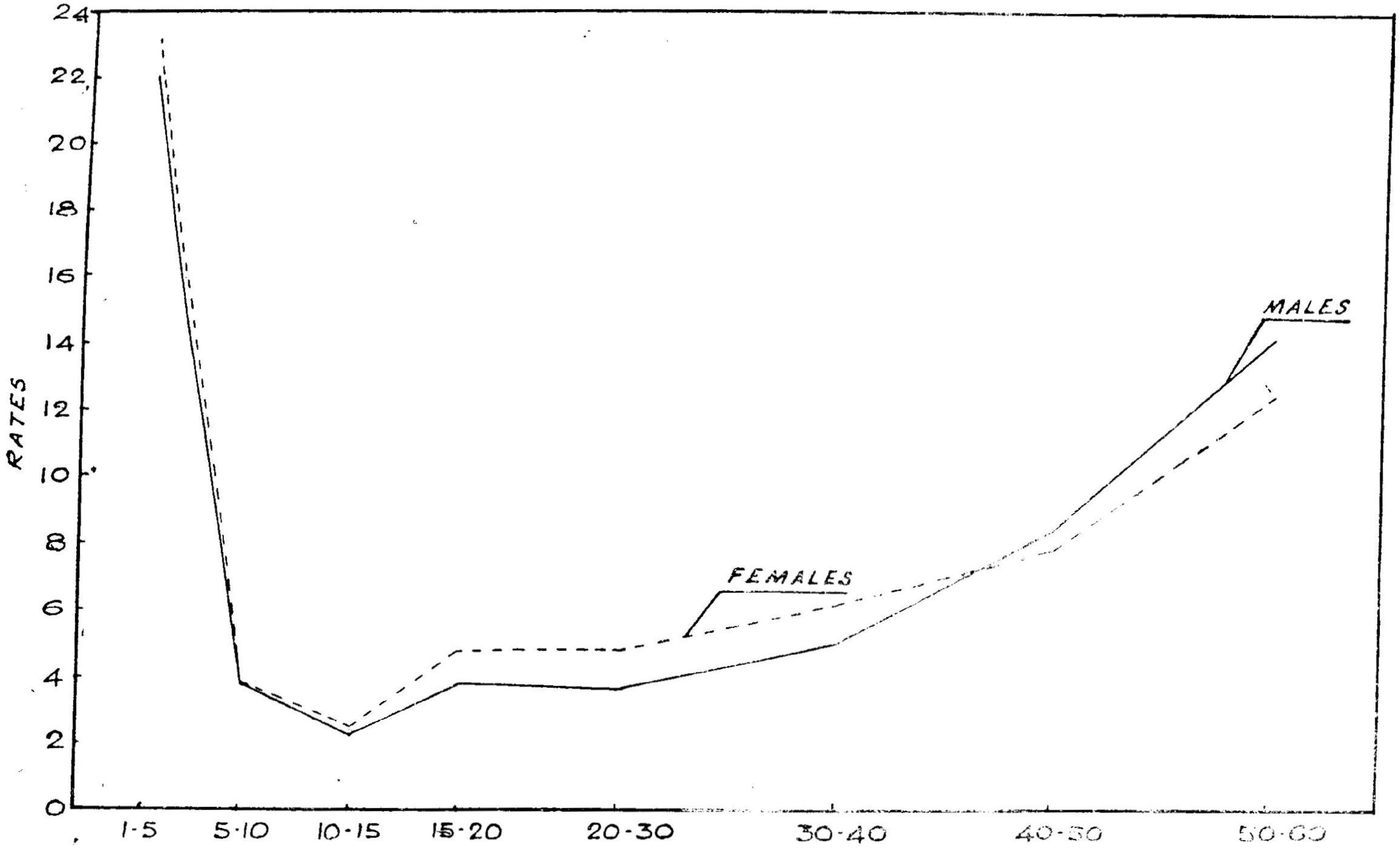
Age groups	1956		1957		1958		1959		1960		Average 1956–60	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
1	2	3	4	5	6	7	8	9	10	11	12	13
Under 1 year *	121.1	112.1	114.4	106.8	107.2	99.4	94.5	87.5	94.5	88.4	106.3	98.8
1— 4 ...	20.9	21.8	24.4	25.2	23.4	24.7	20.0	21.0	21.8	23.5	22.1	23.2
5— 9 ...	3.9	3.8	4.3	4.5	4.4	4.4	3.2	3.2	3.6	3.6	3.9	3·9
10—14 ...	2.6	2.9	2.7	3.3	2.3	2.6	1.9	2.2	1.8	2.0	2.3	2.6
15—19 ...	4.2	5.4	4.4	5.4	3.4	4.7	3.3	4.3	3.0	3.9	3.7	4.7
20—29 ...	3.8	5.3	3.5	4.8	3.6	5.0	3.2	4.4	3.2	4.3	3.5	4.8
30—39 ...	5.7	6.9	5.3	6.6	4.9	6.1	4.6	5.8	4.4	5.5	5.0	6.2
40—49 ...	9.3	8.5	9.2	8.5	8.2	7.6	7.9	7.3	7.7	7.0	8.5	7.8
50—59 ...	15.3	13.7	14.6	12.6	14.5	12.6	13.2	11.1	13.5	11.7	14.2	12.3
60+ ...	57.8	57.4	69.0	68.7	58.4	57.6	56.7	55.7	59.9	58.9	60.4	59.7
All ages ...	13.7	13.6	14.3	14.2	13.1	13.1	12.0	11.9	12.2	12.2	13.1	13.0

* per thousand live births.

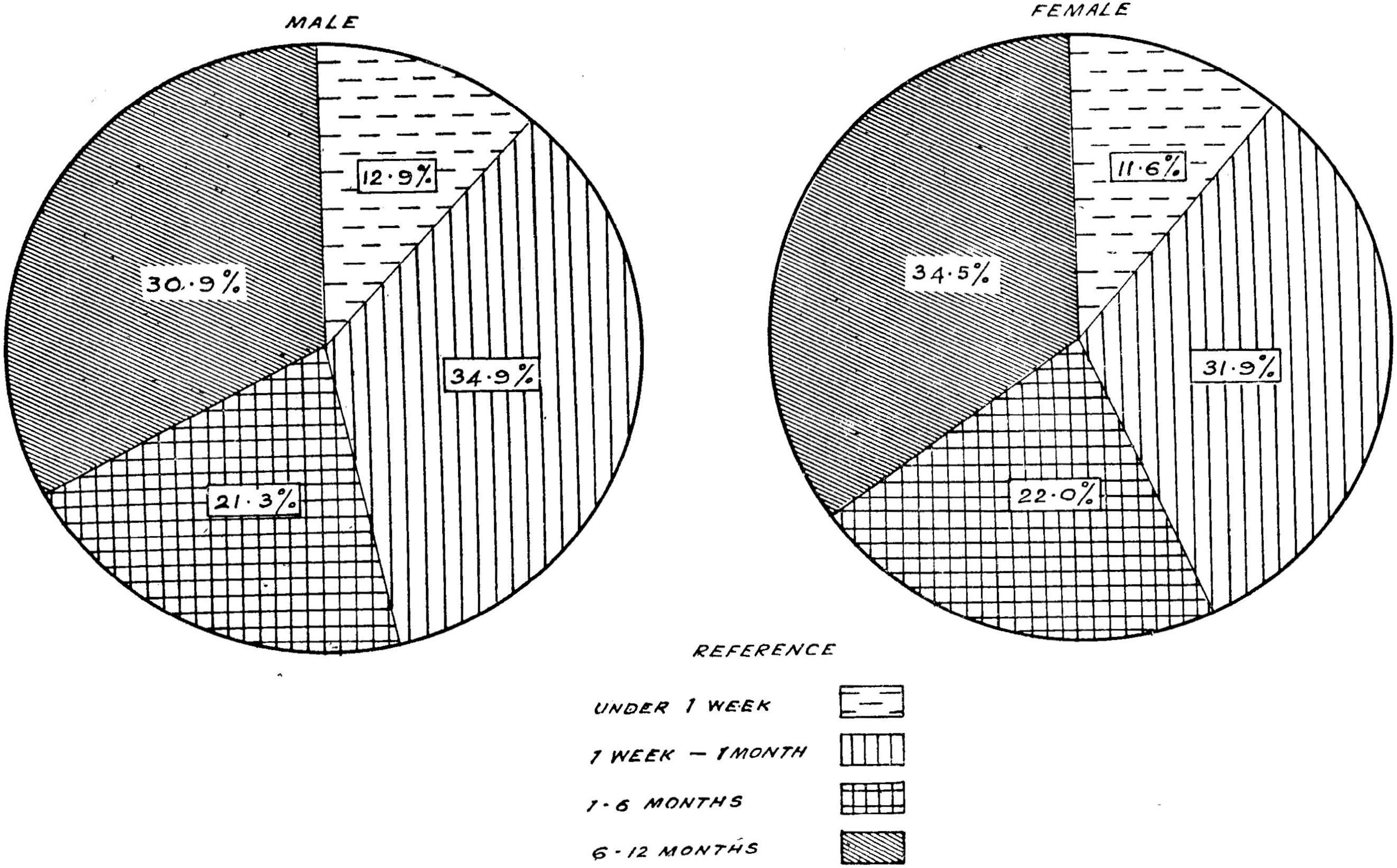
AGE SPECIFIC DEATH RATES, 1951-55, REGISTRATION DATA



AGE SPECIFIC DEATH RATES, 1956-60, REGISTRATION DATA



INFANT DEATHS BY BROAD AGE GROUPS
(IN RURAL AREAS)
1956 — 60



INFANT DEATHS BY BROAD AGE GROUPS
IN URBAN AREAS
1956 – 60

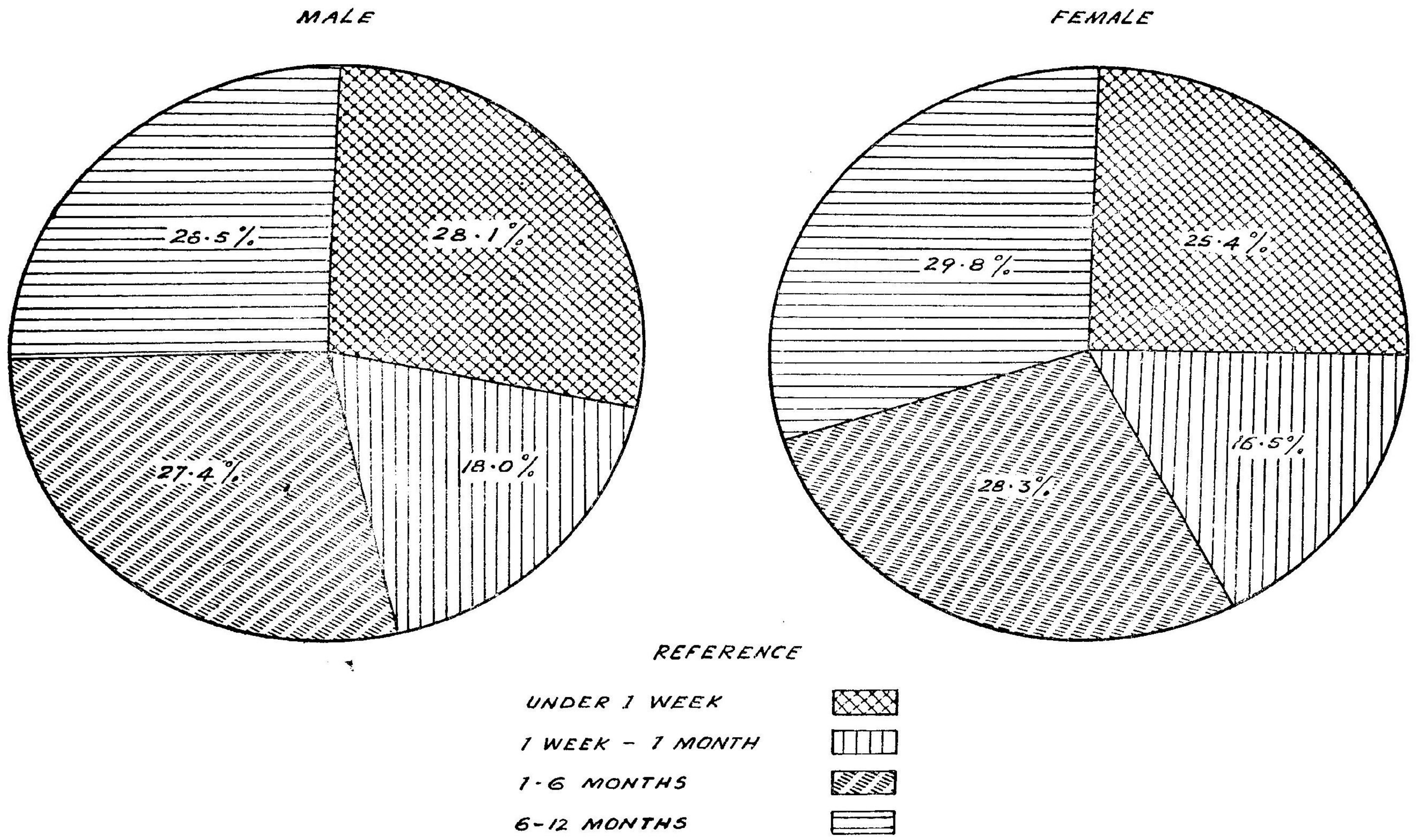


TABLE 5-15

Infant deaths by broad age groups

Age groups	1956 Males No.	1956 Males Percentage	1956 Females No.	1956 Females Percentage	1957 Males No.	1957 Males Percentage	1957 Females No.	1957 Females Percentage	1958 Males No.	1958 Males Percentage	1958 Females No.	1958 Females Percentage
	1	2	3	4	5	6	7	8	9	10	11	12
RURAL												
Under 1 week ...	5,869	14.8	4,448	12.9	5,472	15.5	4,185	13.6	3,351	10.1	2,719	9.4
1 week to 1 month ...	12,986	32.7	10,419	30.3	11,149	31.6	8,635	28.0	12,198	36.7	9,758	33.6
1-6 months ...	7,838	19.8	7,229	21.0	7,321	20.8	6,674	21.7	7,872	23.7	6,905	23.8
6-12 months ...	12,987	32.7	12,296	35.8	11,294	32.1	11,302	36.7	9,810	29.5	9,631	33.2
Under 1 year ...	39,680	100.0	34,392	100.0	35,236	100.0	30,796	100.0	33,231	100.0	29,013	100.0
URBAN												
Under 1 week ...	4,722	29.3	3,707	26.3	4,363	27.2	3,278	23.7	4,045	25.6	3,224	23.9
1 week to 1 month ...	3,043	18.9	2,419	17.1	2,809	17.5	2,284	16.5	2,855	18.1	2,250	16.7
1-6 months ...	4,476	27.8	4,154	29.4	4,466	27.8	4,004	28.9	4,418	28.0	3,838	28.5
6-12 months ...	3,875	24.0	3,839	27.2	4,411	27.5	4,287	30.9	4,474	28.3	4,165	30.9
Under 1 year ...	16,116	100.0	14,119	100.0	16,049	100.0	13,853	100.0	15,792	100.0	13,477	100.0

Age groups	1959 Males No.	1959 Males Percentage	1959 Females No.	1959 Females Percentage	1960 Males No.	1960 Males Percentage	1960 Females No.	1960 Females Percentage	1956-60 Males No.	1956-60 Males Percentage	1956-60 Females No.	1956-60 Females Percentage
	13	14	15	16	17	18	19	20	21	22	23	24
RURAL												
Under 1 week ...	4,205	13.5	3,341	12.5	2,883	9.7	2,400	9.3	21,780	12.9	17,093	11.6
1 week to 1 month ...	11,383	36.7	8,903	33.3	11,235	37.9	9,075	35.1	58,951	34.9	46,790	31.9
1-6 months ...	6,433	20.7	5,610	21.0	6,485	21.9	5,804	22.5	35,949	21.3	32,222	22.0
6-12 months ...	9,033	29.1	8,887	33.2	9,050	30.5	8,547	33.1	52,174	30.9	50,663	34.5
Under 1 year ...	31,054	100.0	26,741	100.0	29,653	100.0	25,826	100.0	168,854	100.0	146,768	100.0
URBAN												
Under 1 week ...	4,453	29.4	3,555	26.9	4,199	29.1	3,318	26.4	21,782	28.1	17,082	25.4
1 week to 1 month ...	2,580	17.1	2,064	15.6	2,668	18.5	2,093	16.7	13,955	18.0	11,110	16.5
1-6 months ...	4,082	27.0	3,663	27.7	3,767	26.2	3,352	26.7	21,209	27.4	19,011	28.3
6-12 months ...	4,001	26.5	3,958	29.8	3,779	26.2	3,784	30.2	20,540	26.5	20,033	29.8
Under 1 year ...	15,116	100.0	13,240	100.0	14,413	100.0	12,547	100.0	77,486	100.0	67,236	100.0

TABLE 5-17

Infant death rate by age groups

Age groups	1956		1957		1958		1959		1960		1956-60	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
RURAL												
Under 1 week ...	18.6	15.1	18.2	15.0	11.0	9.5	12.9	11.0	9.5	8.6	14.0	11.8
1 week to 1 month ...	41.2	35.3	37.0	30.9	39.9	34.2	34.9	29.3	37.1	32.4	38.0	32.4
1-6 months ...	24.9	24.5	24.3	23.9	25.7	24.2	19.7	18.5	21.4	20.7	23.2	22.3
6-12 months ...	41.2	41.7	37.5	40.4	32.1	33.8	27.7	29.2	29.9	30.5	33.6	35.1
Under 1 year ...	125.9	116.6	117.0	110.2	108.7	101.8	95.1	88.0	97.8	92.1	108.8	101.7
URBAN												
Under 1 week ...	32.4	26.9	29.6	23.6	26.7	22.6	27.5	23.2	25.8	21.6	28.3	23.5
1 week to 1 month ...	20.9	17.6	19.1	16.5	18.8	15.8	15.9	13.5	16.4	13.6	18.1	15.3
1-6 months ...	30.8	30.2	30.3	28.9	29.1	26.9	25.2	23.9	23.1	21.8	27.6	26.2
6-12 months ...	26.6	27.9	29.9	30.9	29.5	29.2	24.7	25.8	23.2	24.6	26.7	27.6
Under 1 year ...	110.7	102.5	108.9	99.9	104.1	94.5	93.2	86.4	88.5	81.7	100.7	92.6

TABLE 5-18

Deaths registered by broad age groups for Madras State in 1956-60

Age groups	1956				1957				1958			
	Males	Percentage	Females	Percentage	Males	Percentage	Females	Percentage	Males	Percentage	Females	Percentage
ALL AREAS												
0 ...	55,796	25.5	48,511	22.4	51,285	22.2	44,649	19.4	49,023	22.8	42,490	19.8
1— 4 ...	36,753	16.8	38,259	17.6	43,434	18.8	44,844	19.5	42,178	19.6	44,262	20.7
5— 9 ...	7,986	3.6	7,868	3.6	8,981	3.9	9,224	4.0	9,236	4.3	9,161	4.3
10—14 ...	4,753	2.2	5,125	2.4	4,850	2.1	5,847	2.6	4,311	2.0	4,622	2.2
15—19 ...	5,660	2.6	7,208	3.3	5,991	2.6	7,311	3.2	4,798	2.2	6,453	3.0
20—29 ...	10,141	4.6	15,463	7.1	9,341	4.0	14,180	6.2	9,686	4.5	14,971	7.0
30—39 ...	12,522	5.7	15,088	6.9	11,670	5.1	14,576	6.3	11,099	5.2	13,543	6.3
40—49 ...	15,861	7.3	13,483	6.2	15,991	6.9	13,581	5.9	14,420	6.7	12,270	5.7
50—59 ...	17,398	8.0	14,681	6.8	15,757	7.3	13,621	5.9	16,915	7.9	13,769	6.4
60 + ...	51,766	23.7	51,336	23.7	62,528	27.1	62,161	27.0	53,526	24.8	52,588	24.6
All ages ...	*218,636	100.0	*217,022	100.0	230,828	100.0	229,994	100.0	215,192	100.0	214,129	100.0

* Unadjusted.

DEATHS REGISTERED BY BROAD AGE GROUPS FOR MADRAS STATE IN 1960

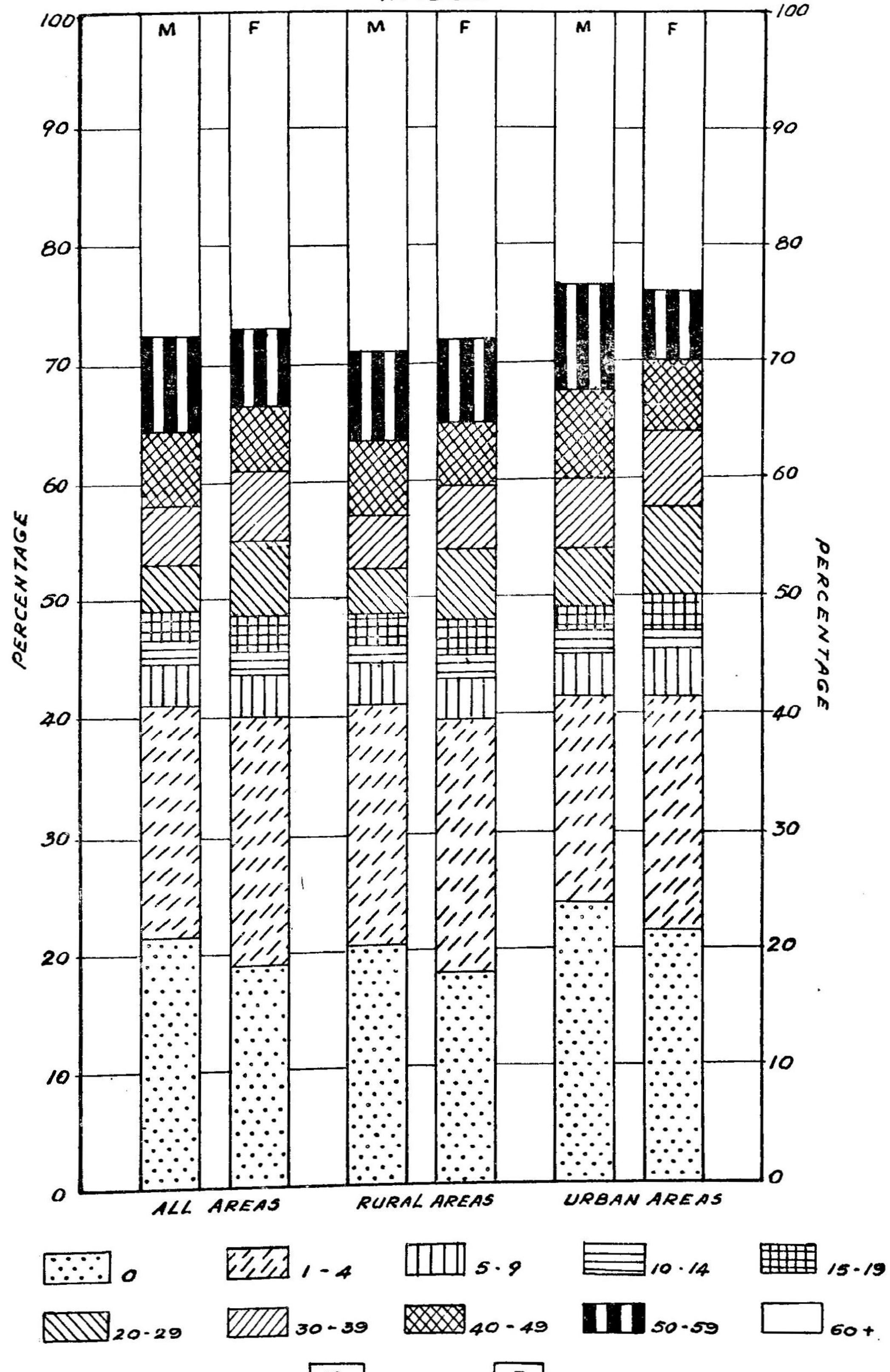


TABLE 5-18—(*Contd.*)

Age groups		1956				1957				1958			
		Males	Percentage	Females	Percentage	Males	Percentage	Females	Percentage	Males	Percentage	Females	Percentage
							RURAL						
0	...	39,680	25.1	34,392	21.8	35,236	21.5	30,796	18.7	33,231	21.9	29,013	18.9
1— 4	...	26,537	16.8	27,176	17.2	30,918	18.8	31,230	18.9	30,283	20.0	31,479	20.5
5— 9	...	5,864	3.7	5,721	3.6	6,177	3.8	6,321	3.8	6,488	4.3	6,530	4.3
10—14	...	3,676	2.3	4,035	2.6	3,599	2.2	4,441	2.7	3,126	2.1	3,385	2.2
15—19	...	4,363	2.8	5,457	3.5	4,465	2.7	5,310	3.2	3,465	2.3	4,652	3.0
20—29	...	6,861	4.3	10,530	6.7	5,756	3.5	9,056	5.5	6,416	4.2	10,044	6.6
30—39	...	8,753	5.6	11,027	7.0	7,772	4.7	10,140	6.2	7,475	4.9	9,483	6.2
40—49	...	11,072	7.0	10,046	6.4	11,066	6.7	9,928	6.0	9,759	6.4	8,892	5.8
50—59	...	11,844	7.5	10,878	6.9	10,980	6.7	9,721	5.9	11,436	7.5	10,119	6.6
60 +	...	39,324	24.9	38,419	24.3	48,274	29.4	48,084	29.1	40,115	26.4	39,609	25.9
All ages	...	*157,974	100.0	*157,681	100.0	164,243	100.0	165,027	100.0	151,794	100.0	153,206	100.0
							URBAN						
0	...	16,116	26.6	14,119	23.8	16,049	24.1	13,853	21.3	15,792	24.9	13,477	22.1
1— 4	...	10,216	16.8	11,083	18.7	12,516	18.8	13,614	21.0	11,895	18.8	12,783	21.0
5— 9	...	2,122	3.5	2,147	3.6	2,804	4.2	2,903	4.5	2,748	4.3	2,631	4.3
10—14	...	1,077	1.8	1,090	1.8	1,251	1.8	1,406	2.2	1,185	1.9	1,237	2.0
15—19	...	1,297	2.1	1,751	3.0	1,526	2.3	2,001	3.1	1,333	2.1	1,801	3.0
20—29	...	3,280	5.4	4,933	8.3	3,585	5.4	5,124	7.9	3,270	5.2	4,927	8.1
30—39	...	3,769	6.2	4,061	6.8	3,898	5.9	4,436	6.8	3,624	5.7	4,060	6.7
40—49	...	4,789	7.9	3,437	5.8	4,925	7.4	3,653	5.6	4,661	7.4	3,378	5.5
50—59	...	5,554	9.2	3,803	6.4	5,777	8.7	3,900	6.0	5,479	8.6	3,650	6.0
60 +	...	12,442	20.5	12,917	21.8	14,254	21.4	14,077	21.6	13,411	21.1	12,979	21.3
All ages	...	*60,662	100.0	*59,341	100.0	66,585	100.0	64,967	100.0	63,398	100.0	60,923	100.0

* Unadjusted.

TABLE 5-18—(*Contd.*)

Age groups		1959				1960			
		Males	Percentage	Females	Percentage	Males	Percentage	Females	Percentage
					ALL AREAS				
0	...	46,170	23.2	39,981	20.3	44,066	21.5	38,373	18.9
1— 4	...	36,474	18.3	38,084	19.4	40,151	19.6	42,985	21.1
5— 9	...	6,883	3.5	6,854	3.5	7,663	3.7	7,748	3.8
10—14	...	3,603	1.8	3,911	2.0	3,496	1.7	3,693	1.8
15—19	...	4,597	2.3	5,965	3.0	4,280	2.1	5,458	2.7
20—29	...	8,836	4.4	13,363	6.8	8,883	4.3	13,174	6.5
30—39	...	10,346	5.2	12,989	6.6	10,171	5.0	12,407	6.1
40—49	...	14,044	7.1	11,863	6.0	13,906	6.8	11,595	5.7
50—59	...	15,494	7.8	12,280	6.2	16,132	7.9	13,052	6.4
60 +	...	52,589	26.4	51,423	26.2	56,278	27.4	54,950	27.0
All ages	...	199,036	100.0	196,713	100.0	205,026	100.0	203,435	100.0
					RURAL				
0	...	31,054	22.3	26,741	19.3	29,653	20.5	25,826	17.8
1— 4	...	26,121	18.8	26,918	19.4	29,444	20.4	31,381	21.6
5— 9	...	4,781	3.4	4,808	3.5	5,451	3.8	5,509	3.8
10—14	...	2,502	1.8	2,854	2.1	2,394	1.7	2,694	1.9
15—19	...	3,328	2.4	4,307	3.1	3,042	2.1	3,900	2.7
20—29	...	5,577	4.0	8,631	6.2	5,705	3.9	8,713	6.0
30—39	...	6,883	5.0	8,915	6.4	6,682	4.6	8,512	5.8
40—49	...	9,612	6.9	8,594	6.2	9,339	6.5	8,351	5.7
50—59	...	10,037	7.2	8,648	6.2	10,636	7.3	9,444	6.5
60 +	...	39,286	28.2	38,230	27.6	42,212	29.2	41,087	28.2
All ages	...	139,181	100.0	138,646	100.0	144,558	100.0	145,417	100.0
					URBAN				
0	...	15,116	25.3	13,240	22.8	14,413	23.8	12,547	21.6
1— 4	...	10,353	17.3	11,166	19.2	10,707	17.7	11,604	20.0
5— 9	...	2,102	3.5	2,046	3.5	2,212	3.7	2,239	3.9
10—14	...	1,101	1.8	1,057	1.8	1,102	1.8	999	1.7
15—19	...	1,269	2.1	1,658	2.9	1,238	2.0	1,558	2.7
20—29	...	3,259	5.5	4,732	8.2	3,178	5.3	4,461	7.7
30—39	...	3,463	5.8	4,074	7.0	3,489	5.8	3,895	6.7
40—49	...	4,432	7.4	3,269	5.6	4,567	7.6	3,244	5.6
50—59	...	5,457	9.1	3,632	6.3	5,496	9.1	3,608	6.2
60 +	...	13,303	22.2	13,193	22.7	14,066	23.2	13,863	23.9
All ages	...	59,855	100.0	58,067	100.0	60,468	100.0	58,018	100.0

CHAPTER VI

LIFE TABLES

It is the usual practice in the Indian Censuses to present a series of life tables for India and for different regions of the country grouped on a Zonal basis. These life tables are prepared by the census actuary of the Office of the Registrar-General, on a more or less uniform basis for each Zone and for India as a whole. This practice has been followed in the 1961 Census also and Shri S. P. Jain, the Indian census actuary has prepared a set of life tables for India and for each Zone for the 1951–60 decade.

Under this scheme the south zone comprises Madras, Kerala, Andhra and Mysore States. Those who are familiar with the demographic situation of these different States are well aware of the divergencies in the demographic situation in these different states, particularly from the standpoint of health and longevity of life and it is our view that while the Zonal Life Tables can be adopted for larger analytical purposes, a more detailed picture of the demographic situation in each State calls for an individual series of life tables.

There are many problems that confront the demographer who attempts the framing of a life table for a State like Madras which is subject to the pressures of migration. It is our aim to focus the drawbacks in methodology, so that better tools of demographic analysis could be perfected in future and better and more detailed data are built up.

We will briefly explain the methodology followed for the construction of the Abridged Life Tables given in this chapter. The method is based, in principle, on tracing cohorts living at one point of time to their survivors at another point of time, since the registration data are found to be inadequate and incomplete for the task. The basic data for the study is therefore the single year age returns for 1951 and 1961, the former available on a 10% sample basis and the latter for the entire population. Of course some adjustments had to be made for the changes in boundaries to bring the 1951 data on a par with that of 1961, and further the age distribution for the entire population in 1951 was obtained by projecting from the sample population. There are two major problems which required solution in the application of the method. One is the defect in the age returns and another is the adjustment for migration change. These are discussed below.

Age Smoothing

Since our method of constructing Life Tables for Madras involved differencing of two consecutive censuses, the age distributions had to be smoothed. As the age distributions stood, the same cohort that was deficiently distributed in 1951 could be over-reported at the 1961 Census or vice versa. This would yield, for the given cohort a heavy under-estimation or over-estimation of deaths. The features of the Madras age returns and the manner in which group population corrected for systematic bias may be obtained are explained in the Chapter on *Age* in the General Report for Madras State. The method adopted here is slightly different, since the pivotal values for the conventional groups 0–4, 5–9 . . . . . will not be suitable for our purpose and so an alternative method will be needed to give the pivotal values, 5, 10, 15, etc. For the 1961 Census, Sri S. P. Jain has worked out the smoothed single year returns for Madras State and this has been adopted for the 1961 age distribution. For obtaining the smoothed age distribution for 1951, we have adopted a procedure similar to the one followed by Jain in his "Age Tables—1951 Census," and it would suffice here to give briefly the manner in which the group populations are obtained for calculating the pivotal values. Populations by single years of age for the State for each sex are combined to give a population in quinary age group : 3–7, 8–12, 13–17 etc. Necessary transfers are made to remove systematic bias. In this method, a group population is replaced by the average of the group, the preceding and the succeeding groups weighted in the ratio, 1 : 2 : 1. From the group populations thus obtained, the populations at the mid-ages 5, 10, ... are calculated with the help of Dr. Kozakeiwicz's Osculatory Interpolation Formulae given at the end. The formulae (k) to (o) assume differences of fifth and higher order of the group populations to be negligible and distribute group population into population at individual ages in such a manner that the population changes smoothly from age to age. The formulae involve five group totals, two on either side of the group concerned. The formula which gives the population of the mid-age 15 is,

$$10{,}000\ u_{15} = 66\ w_5 - 344\ w_{10} + 2556\ w_{15} - 344\ w_{20} + 66\ w_{25}$$

where w_5 represents the population of the group 3–7 whose pivotal age is 5. The formulae cannot obviously give the population at ages 5 and 10. For this purpose formulae (*a*) to (*j*) are employed. For instance, population at age 5 is obtained from

$$10{,}000\ u_5 = 1{,}840\ w_5 + 400\ w_{10} - 320\ w_{15} + 80\ W_{20}$$

and population at age 10 from

$$10{,}000\ u_{10} = -80\ w_5 + 2{,}160\ w_{10} - 80\ w_{15}$$

The population of the end group 3–7 adopted in the above formulae is obtained in a rough and ready way by subtracting the population in the group 3–12 after smoothing from the unsmoothed population of the group 3–12. The value of u_5 obtained in this manner is checked with the value of 1/8th of the population enumerated at ages 1 to 9. For the 1961 Census, Jain has worked out a smoothed age distribution on the above procedure and this was adopted. Before proceeding to use these figures for 1961, we will have to make adjustments for migration, which is described below.

Adjustment for migration

Unlike in the earlier Censuses, we have data on the migrants by duration of residence and also the age distribution of migrants of less than 5 years duration. From the former it is possible to work out the total in and out migrants during the last decade and from the latter it is possible to obtain their age distribution based on suitable assumptions. However, as indicated in the Chapter on *Migration*, it was found that the place of birth data has a tendency to underestimate out-migration from Madras probably as a result of the tendency of Madrasi migrants to report the State of residence as the State of origin. By a different procedure, also discussed in the Chapter on *Migration*, we have estimated the net out-migration during 1951–61 to be of the order of 4%. This was adopted for our purpose here together with the age distribution of migrants of those of less than 5 years duration. The age periods for which data are available are 0–2, 3–12, 13–22, 23–32, 33–42, 43–52, and 53+. Assuming that the in and out migrants in each of these broad age groups will be equally distributed in their quinquennial component age periods, it is possible to obtain the number of in and out migrants in 3–7, 8–12, 13–17, 18–22 etc. Further since the age distribution is available only for those of less than 5 years duration, we may assume that this distribution will hold good for those of less than 10 years duration. The out-migrants in each age group was added to the population in this age group from 1961 Census and the in-migrants were subtracted. In other words the natural population in each age group was worked out.

Derivation of mortality rates

These populations for 1951 and 1961 for the State are used for working out the mortality rates, on the assumption that there is a common mortality scale, which is applicable to all generations crossing the intercensal period. Persons, who may be living at age x at any time in the intercensal period, are subject to q_x, the rate of mortality at age x according to this common mortality scale. In this way the 1951 population moves on to the 1961 population under the operation of this common scale. If L_x represents the number of persons living between ages x and x + 1 at any time in the community subject to these rates of mortality, P_x and P^1_{x+10} should be taken as the observed values of L_x and L_{x+10} at times of the Censuses. Thus, $\dfrac{P^1_{x+10}}{P_x} = \dfrac{L_{x+10}}{L_x}$

Adopting the well-known approximation $L_x = l_{x+\frac{1}{2}}$ where l_x represents the usual life table number surviving to age x, we have

$$\frac{P^1_{x+10}}{P_x} = \frac{l_{x+10+\frac{1}{2}}}{l_{x+\frac{1}{2}}} = {}_{10}p_{x+\frac{1}{2}}$$

which gives the probability that a person exactly aged $x + \frac{1}{2}$ will survive for the next 10 years.

Calculation of p_x for ages 5–60

Once we obtain the value of ${}_{10}p_{x+\frac{1}{2}}$ where x stands for 5, 10, 15 etc., the values of p_x may be calculated from the following approximation.

$$\tfrac{1}{4}(\log {}_{10}p_x + \log {}_{10}p_{x+5})$$

$$= \tfrac{1}{4}\left\{ \sum_{t=0}^{4} \log p_{x+t} + 2 \sum_{t=5}^{9} \log p_{x+t} + \sum_{t=10}^{14} \log p_{x+t} \right\}$$

$$= \sum_{t=5}^{9} \log p_{x+t} \text{ approximately } \log {}_5p_x$$

The method described above gives firm estimates of p_x for the ages 5 to 60. Other methods have to be adopted to extend the rates to the extremities of span of life. Since the age returns for very old ages, say above 60 are unreliable, the above method is not applicable for ages beyond 60. Likewise there are no data on which to base the rates below age 5. Therefore these two age sectors are treated in a slightly different manner as described below.

Extension to ages over 60

To obtain values of p_x for ages beyond 60, a Gompertz curve was fitted at ages 45, 50, 55 and 60 by the method of moments using the relation $\text{colog } p_x = BC^x$

Hence $\log(\text{colog } p_x) = \log B + x \log C$

The original values between 45 and 60, fitted well with those calculated from the Gompertz curve and the values for ages 60 and over were, therefore, adopted as such.

Extension to ages below 5

Values of l_x are projected for values of x below age 5 by fitting the equation.

$$l_x = A + Hx + Bc^x + \frac{m}{nx+1}$$

to the values of l_x for ages 5 and above. The above equation has been employed by Shri L. S. Vaidyanathan for the construction of the 1931 Life Tables and by Shri S. P. Jain for 1951 and 1961 Life Tables. Their calculations have shown B to be a positive large number and c, a positive fraction. Thus the term Bc^x decreases in geometric progression with increase in age which indicates that the role of c is to regulate the decrease in the extra child mortality as age increases. Shri Jain has determined the value of c by calculations made on the average rates of mortality at ages 1, 2 and 3 shown by old foreign well constructed life tables which show a mortality level as heavy as is known to prevail in India. The value of c is found to be 0.45 for males and 0.47 for females.

The values of the constants A, H and B in the expression for l_x have been determined by fitting the equation without the last term $\frac{m}{nx+1}$ to l_5, l_6 and l_7. Now we have values of l_x for only 5, 10 etc., and not for x = 6 and 7. This is obtained by applying Dr. Kozakeiwicz's Osculatory Interpolation formula to the quinquennial values of log $_5p_x$ and then finding the antilogarithm of the interpolated values.

The term $\frac{m}{nx+1}$ has been used by Sarvasri Vaidyanathan and Jain only to provide for a heavy infant mortality which is characteristic of the Indian experience. This term should become insignificant when x reaches the age 5 and Jain has taken n as 20, since this served the purpose alright. The constant m is so determined that the ratio l_1 to l_0 gives the average infant mortality rate for the Zone during the intercensal period. Owing to the unreliability of registration records, the registered infant mortality rates do not serve the purpose. From general considerations a lower and an upper value of infant mortality rates have been fixed as 130 and 150 respectively which are considered to be safe limits within which the true value would lie. While it is considered that this would meet the ends of scientific accuracy, for practical purposes definite values of the rate of mortality for ages 0–4 are still needed. Accordingly, a definite value of infant mortality based on an intelligent guess has been assumed so that the life table can be extended below age 5 on this basis. Shri Jain has assumed a probable infant mortality rate of 170 for the decade 1941–50. For 1951–60, it must be still less and further the infant death rates for Municipalities around 1955–56 is about 120. The Poonamallee Health Survey has indicated a rate of 135 for 1951–52. Keeping in view all these facts a slightly higher rate of 140 has been adopted in the present study.

This has been adopted as the value of q_0 for the life table. From this value m can be calculated as follows. Let a_0 and a_1, be the values of the expression $A + Hx + Bc^x$ when x = 0 and x = 1. Then

$$l_0 = a_0 + m$$

$$l_1 = a_1 + \frac{m}{21}$$

Also $l_1 = p_0 l_0 = (1 - q_0) l_0$

These equations give

$$m = \frac{a_1 - a_0(1-q_0)}{\left(\frac{20}{21} - q_0\right)}$$

From the value of m thus obtained values of l_x are got, which enable the table below age 5 to be completed.

Derivation of the other functions of the Life Table

From the values of l_x thus obtained the values of the functions d_x, q_x, L_x, T_x and e^o_x are obtained in the usual manner. The values of L_x for x below 5 are obtained by the integration of the expression adopted in the calculation.

For instance $L_0 = \int_0^1 A + Hx + Bc^x + \frac{m}{nx+1}\,dx$

$$= A + \frac{H}{2} + \frac{B}{\log c}(c-1) + \frac{m}{n}\log(n+1)$$

Likewise

$$L_1 = A + \frac{3H}{2} + \frac{Bc}{\log c}(c-1) + \frac{m}{n}\log\frac{(2n+1)}{n+1}$$

$$L_2 = A + \frac{5H}{2} + \frac{Bc^2}{\log c}(c-1) + \frac{m}{n}\log\frac{(3n+1)}{(2n+1)}$$

$$L_3 = A + \frac{7H}{2} + \frac{Bc^3}{\log c}(c-1) + \frac{m}{n}\log\frac{(4n+1)}{(3n+1)}$$

$$L_4 = A + \frac{9H}{2} + \frac{Bc^4}{\log c}(c-1) + \frac{m}{n}\log\frac{(5n+1)}{(4n+1)}$$

For the other ages, L_x is obtained by the usual method of averaging l_x and l_{x+1}. These give Tx and e^o_x by the equations.

$$T_x = \sum_{t=x}^{w} L_t \text{ and } e^o_x = \frac{T_x}{l_x}$$

The above equation gives the complete expectation of life at each age x.

TABLE 6–1

Abridged Life Tables for Madras, 1951–61

MALES

Age x	Survivors to exact age x l_x	Probability of dying in interval $_nq_x$	Population living in age interval L_x	Living above age x T_x	Mean after life-time e_x^o
0	124,560	.14000	115,660	4,964,304	39.85
1	107,121	.02725	108,209	4,848,644	45.26
2	104,203	.01166	104,556	4,740,435	45.49
3	102,988	.01638	102,380	4,635,879	45.01
4	101,301	.01284	100,863	4,533,499	44.75
5	100,000	.04957	487,608	4,432,636	44.33
10	95,043	.03529	466,828	3,945,028	41.50
15	91,688	.01401	455,228	3,478,200	37.93
20	90,403	.01371	448,918	3,022,972	33.43
25	89,164	.02787	439,608	2,574,054	28.86
30	86,679	.05138	422,260	2,134,446	24.62
35	82,225	.08565	393,518	1,712,186	20.83
40	75,182	.12798	351,855	1,318,668	17.54
45	65,560	.17680	298,823	966,813	14.75
50	53,969	.22714	239,198	667,990	12.38
55	41,710	.29415	177,878	428,792	10.28
60	29,441	.36451	120,375	250,914	8.52
65	18,709	.45488	72,270	130,539	6.98
70	10,199	.55335	36,885	58,269	5.71
75	4,555	.65725	15,290	21,384	4.69
80	1,561	.75889	4,843	6,094	3.90
85	376	.84886	1,083	1,251	3.33
90	57	.91875	155	168	2.95
95	5	.96437	13	13	2.60
100	...	.98809	...	...	...
105	...	.99722	...	...	...

TABLE 6–2

Abridged Life Tables for Madras, 1951–61

FEMALES

Age x	Survivors to exact age x l_x	Probability of dying in interval $_nq_x$	Population living in age interval L_x	Living above age x T_x	Mean after life-time e_x^o
0	123,288	.14000	115,593	4,714,498	38.24
1	106,028	.02601	107,726	4,598,905	43.37
2	103,271	.01481	104,000	4,491,179	43.49
3	101,742	.00978	101,980	4,387,179	43.12
4	100,747	.00741	100,756	4,285,199	42.53
5	100,000	.02982	492,545	4,184,443	41.84
10	97,018	.01707	480,950	3,691,898	38.05
15	95,362	.01503	473,228	3,210,948	33.67
20	93,929	.04530	459,008	2,737,720	29.15
25	89,674	.08207	429,970	2,278,712	25.41
30	82,314	.09714	391,580	1,848,742	22.46
35	74,318	.11253	350,683	1,457,168	19.61
40	65,955	.14724	305,498	1,106,479	16.78
45	56,244	.19434	253,895	800,981	14.24
50	45,314	.24090	199,280	547,086	12.07
55	34,398	.30530	145,735	347,806	10.11
60	23,896	.37481	97,090	202,071	8.46
65	14,940	.45664	57,645	104,981	7.03
70	8,118	.54697	29,490	47,336	5.83
75	3,678	.64220	12,485	17,846	4.85
80	1,316	.73663	4,158	5,361	4.07
85	347	.82303	1,020	1,203	3.47
90	61	.89439	168	183	3.00
95	6	.94596	15	15	2.50
100	...	.97736	...	...	...
105	...	.99251	...	...	...

Summary and Conclusions

The life tables for males and females are presented in Tables 6–1 and 6–2. Our computations reveal an expectancy of life at birth of 39.85 for males and 38.24 for females which is less than the expectancy at birth for the south zone computed by Shri S. P. Jain and presented in the 1961 Census Life Tables. This seems to indicate that the health situation in the State is poorer than the rest of the South Zone. Another interesting point is that our estimate is very close to the one obtained by Shri Jain by using a Quasi stable population model. But since he has not worked out life tables for the State, it has not been possible to attempt an age-by-age comparison.

We may caution the user of these life tables regarding certain limitations inherent in the data as well as the methodology adopted :

(1) The basis for the derivation of the Life Tables are the age data. The age distribution itself is highly distorted by errors in age reporting and preferences for digits 0, 5, 2 and 8. This calls for careful adjustment of the age data.

(2) Migration poses the major problem in the computation of Madras life tables. The place of birth data seem to underestimate out-migration particularly in the Madras situation probably due to the tendency of Madrasi out-migrants to report themselves as born in the place of residence.

Considerable caution is therefore required in the use of the place of birth data in the estimation of migration. We have used an estimate of out-migration of 4% obtained by other procedures. Since data on the age of migrants during the 1951–61 decade were not tabulated, we have adopted the age distribution of migrants of less than 5 years duration in the absence of other data regarding the age distribution of migrants. The above data may or may not be relevant to the situation of the whole decade and further there was no means available to us to correct the deficiencies in the age reporting of migrants.

(3) We have adopted a figure of 140 as the infant mortality rate for Madras State during the 1951–61 decade. This is only a notional figure based on empirical considerations and with the perfection of vital statistical data, it will be possible to make more accurate assumptions of the infant mortality rate.

Dr. KOZAKEIWICZ'S Osculatory Interpolation Formulae

$$10{,}000\,U_0 = 3616\,W_0 - 2768\,W_5 + 1488\,W_{10} - 336\,W_{15} \quad (a)$$

$$10{,}000\,U_1 = 2640\,W_0 - 960\,W_5 + 400\,W_{10} - 80\,W_{15} \quad (b)$$

$$10{,}000\,U_2 = 1840\,W_0 + 400\,W_5 - 320\,W_{10} + 80\,W_{15} \quad (c)$$

$$10{,}000\,U_3 = 1200\,W_0 + 1360\,W_5 - 720\,W_{10} + 160\,W_{15} \quad (d)$$

$$10{,}000\,U_4 = 704\,W_0 + 1968\,W_5 - 848\,W_{10} + 176\,W_{15} \quad (e)$$

$$10{,}000\,U_5 = 336\,W_0 + 2272\,W_5 - 752\,W_{10} + 144\,W_{15} \quad (f)$$

$$10{,}000\,U_6 = 80\,W_0 + 2320\,W_5 - 480\,W_{10} + 80\,W_{15} \quad (g)$$

$$10{,}000\,U_7 = -80\,W_0 + 2160\,W_5 - 80\,W_{10} \quad (h)$$

$$10{,}000\,U_8 = -160\,W_0 + 1840\,W_5 + 400\,W_{10} - 80\,W_{15} \quad (i)$$

$$10{,}000\,U_9 = -176\,W_0 + 1408\,W_5 + 912\,W_{10} - 144\,W_{15} \quad (j)$$

Dr. KOZAKEIWICZ'S Osculatory Interpolation Formulae—(*Contd.*)

$$10{,}000\,U_{10} = -128\,W_0 + 848\,W_5 + 1504\,W_{10} - 240\,W_{15} + 16\,W_{20} \qquad (k)$$

$$10{,}000\,U_{11} = -16\,W_0 + 145\,W_5 + 2218\,W_{10} - 409\,W_{15} + 62\,W_{20} \qquad (l)$$

$$10{,}000\,U_{12} = 66\,W_0 - 344\,W_5 + 2556\,W_{10} - 344\,W_{15} + 66\,W_{20} \qquad (m)$$

$$10{,}000\,U_{13} = 62\,W_0 - 409\,W_5 + 2218\,W_{10} + 145\,W_{15} - 16\,W_{20} \qquad (n)$$

$$10{,}000\,U_{14} = 16\,W_0 - 240\,W_5 + 1504\,W_{10} + 848\,W_{15} - 128\,W_{20} \qquad (o)$$

$$10{,}000\,U_{90} = -144\,W_{80} + 912\,W_{85} + 1408\,W_{90} - 176\,W_{95} \qquad (p)$$

$$10{,}000\,U_{91} = -80\,W_{80} + 400\,W_{85} + 1840\,W_{90} - 160\,W_{95} \qquad (q)$$

$$10{,}000\,U_{92} = -80\,W_{85} + 2160\,W_{90} - 80\,W_{95} \qquad (r)$$

$$10{,}000\,U_{93} = 80\,W_{80} - 480\,W_{85} + 2320\,W_{90} + 80\,W_{95} \qquad (s)$$

$$10{,}000\,U_{94} = 144\,W_{80} - 752\,W_{85} + 2272\,W_{90} + 336\,W_{95} \qquad (t)$$

$$10{,}000\,U_{95} = 176\,W_{80} - 848\,W_{85} + 1968\,W_{90} + 704\,W_{95} \qquad (u)$$

$$10{,}000\,U_{96} = 160\,W_{80} - 720\,W_{85} + 1360\,W_{90} + 1200\,W_{95} \qquad (v)$$

$$10{,}000\,U_{97} = 80\,W_{80} - 320\,W_{85} + 400\,W_{90} + 1840\,W_{95} \qquad (w)$$

$$10{,}000\,U_{98} = -80\,W_{80} + 400\,W_{85} - 960\,W_{90} + 2640\,W_{95} \qquad (x)$$

$$10{,}000\,U_{99} = -336\,W_{80} + 1488\,W_{85} - 2768\,W_{90} + 3616\,W_{95} \qquad (y)$$

CHAPTER VII

ENVIRONMENTAL FACTORS AFFECTING MORTALITY

We have seen that besides age and sex, a number of other factors such as the conditions under which people live, work, play and sleep also affect mortality. In western countries it has been found that even marital condition plays an important part in determining the mortality level. For example, mortality from cancer of uterus is higher among married than among unmarried women while mortality from breast cancer though higher among married than among unmarried women during the child bearing years, is higher among unmarried or among childless married women at older ages and there are of course risks associated with child bearing itself. Married men have the advantage of home comforts and some one to look after them when they are sick. The fact is that mortality of married persons is higher than that of unmarried and widowed persons at all ages in the case of men and at younger ages in the case of women ; the mortality of old women is generally much the same in all marital classes. We have little data with which we can analyse the influence of marital condition on mortality in the State.

In this Chapter we have mainly drawn upon two important evidences concerning mortality. One is the child survival indices for social classes derived from the Family Planning Survey of Madras City and the other is the registration data on the monthly distribution of the deaths from each cause.

Caste differentials

The institution of caste is perhaps the most important in the Indian setting. Each caste has its own mode of behaviour, sense of hygiene and food habits, each having its impact on the general health of the community and its mortality rate. The following table gives the percentage of survivors among children born to women covered by the Family Planning Survey and its counterpart, the percentage of deaths among the children born.

TABLE 7-1

Percentage of survivors among children by Caste

Caste	Percentage of survivors	Percentage of dead
1. Brahmins	86.9	13.1
2. Vellalas	83.1	16.9
3. Vanniars & Goundars ...	77.3	22.7
4. Nadars, Shanars & Weaving communities	85.2	14.8
5. Nattukottai Chettiars & other Tamilian Chettiars ...	77.9	22.1
6. Mukkulathores and other allied Castes, Asaris & Fishermen communities	73.4	26.6
7. Idayars, Konars & other Shepherd Castes, Barbers, Dhobies & other Backward castes ...	80.7	19.3
8. Scheduled Castes & Tribes ...	78.9	21.1
9. Other Non-Brahmin castes ...	84.0	16.0
10. Others	86.7	13.3
All classes	82.2	17.8

It appears that if all classes are considered, only 82% of the children born have survived. This may be regarded as an average experience of all the women considered, but in recent years there has been a definite decline in mortality and this is bound to have an effect on the child survival index. If we compare this average experience of mortality for the individual castes, we find Brahmins, Nadars, Shanars, Weaving communities and others have a higher rate of survival.

Brahmins are traditionally vegetarians and are also known for their clean habits. It is not clear how much each of these factors has contributed to the higher rate of survival in this community. The other castes include Muslims, Christians and Anglo-Indians who are mostly non-vegetarians and the closeness of the child survival index for this group with that of the Brahmins seems to indicate that vegetarianism may not be the major factor influencing mortality. The Mukkulathores, and other backward castes, the most backward castes such as Idayars, Konars etc., and the Scheduled Castes and Scheduled Tribes stand at the bottom with the proportion of mortality among children ranging from 17 to

25. This is understandable as socially and economically too they stand at the lower level. The food habits, personal care and hygiene are related to economic and social levels, particularly in the Indian society and it appears probable that this is the stratum of society which is subject to sub-standard diet, malnutrition and the influence of deficiency diseases. This picture is amply supported by the evidences regarding educational, occupational and other differentials discussed in later sections of this Chapter.

Differentials by educational level

It is common experience that sophistication and education go together. Education, by bringing about a greater awareness of life and nature leads to a better equipment of man to condition himself to his environment. This is good in itself since this helps man to ward off illness by preventive measures and to recover himself as speedily as possible by curative methods. We should also expect an association between educational level and health, on purely *a priori* grounds. The better educated are generally the more well to do and the well to do may be expected to have a better nourishment and a more healthy life. The following figures indicate a correlation between educational level and survival rate.

TABLE 7–2

Survival rates of children by educational level of father

Educational level of father	Percentage of survivors	Percentage of dead
1. Illiterates	74.3	25.7
2. Literates	79.4	20.6
3. Education below Matriculation ...	84.1	15.9
4. Matriculation & above ...	88.8	11.2
5. Graduates and Diploma holders in Engineering	92.1	7.9
6. All classes	82.2	17.8

We notice a steady increase in the percentage of survivors among children born in the classes 1 to 5. While illiterates have lost 26% of the children born, Graduates have lost only 8%. This has a far reaching implication *viz.*, that as our education programmes bear fruit and as literacy is improved, it is bound to have an effect on the level of health of the community. The decline in the death rate during the last decade can therefore be attributed to a certain extent to the progress of education in the State.

The influence of type of tenancy and type of family on the mortality level

The Family Planning Survey of Madras City 1963–64, has been useful for deriving the child survival and death indices for different types of tenancy and different types of family. We have distinguished three types of tenancy *viz.*, hut (H), independent flat (F) or a portion of house (P). Huts are characterised by their mud walls and thatched roofs. Independent flats will have a separate entrance and separate bath and lavatories, whereas portions of a house will involve sharing of these amenities with the co-tenants. We have also distinguished three types of tenancies. A simple family consists of a husband and wife with or without their never married children. Intermediate family consists of a couple with one of their parents, their unmarried brother or sister or other relation. The joint family is one where there are two married women. It is of interest to examine whether the types of tenancy and family have a bearing on the mortality level and this is obtained from Table 7–3.

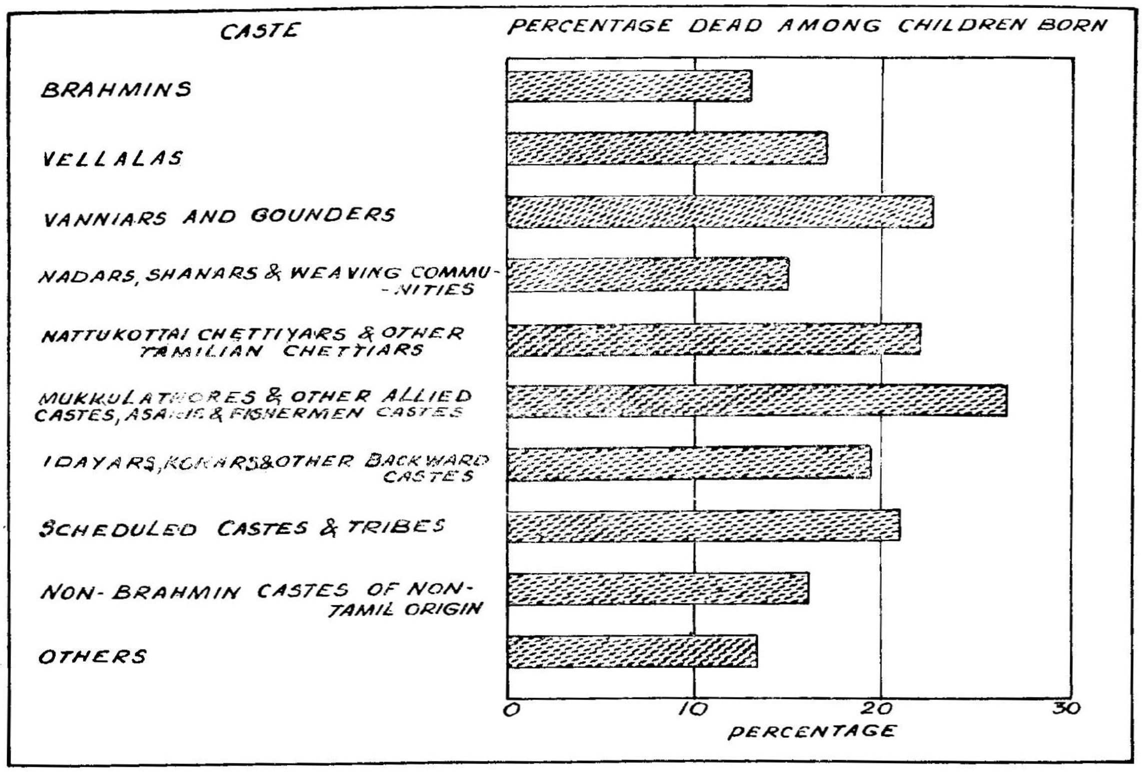
TABLE 7–3

Mortality level by types of tenancy and types of family

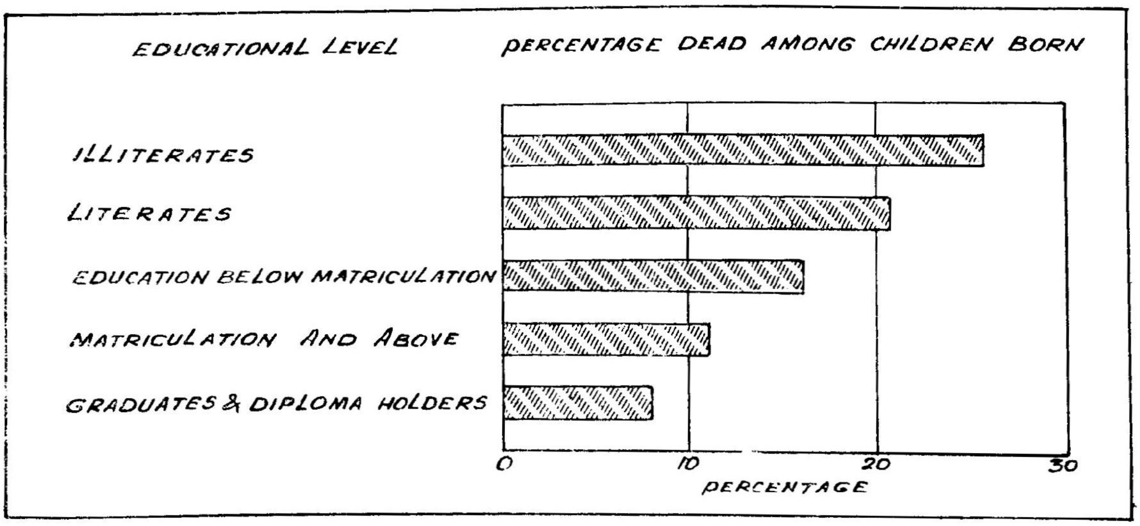
Type of tenancy	Type of family	Percentage of survivors	Percentage of dead
Hut ...	Simple family ...	72.2	27.8
	Joint family ...	75.5	24.5
	Intermediate family ...	80.2	19.8
	All types of families ...	73.7	26.3
Flats ...	Simple family ...	87.9	12.1
	Joint family ...	90.7	9.3
	Intermediate family ...	83.1	16.9
	All types of families ...	87.9	12.1
Portions ...	Simple family ...	83.0	17.0
	Joint family ...	84.4	15.6
	Intermediate family ...	84.6	15.4
	All types of families ...	83.4	16.6
All tenancy...	......	82.2	17.8

Table 7–3 shows that the percentage of survivors is the highest *viz.*, 87.9% among those living in independent flats which speaks of the comparatively high standard of living of this class and its effect on survival. Ranking next are the people sharing their houses with

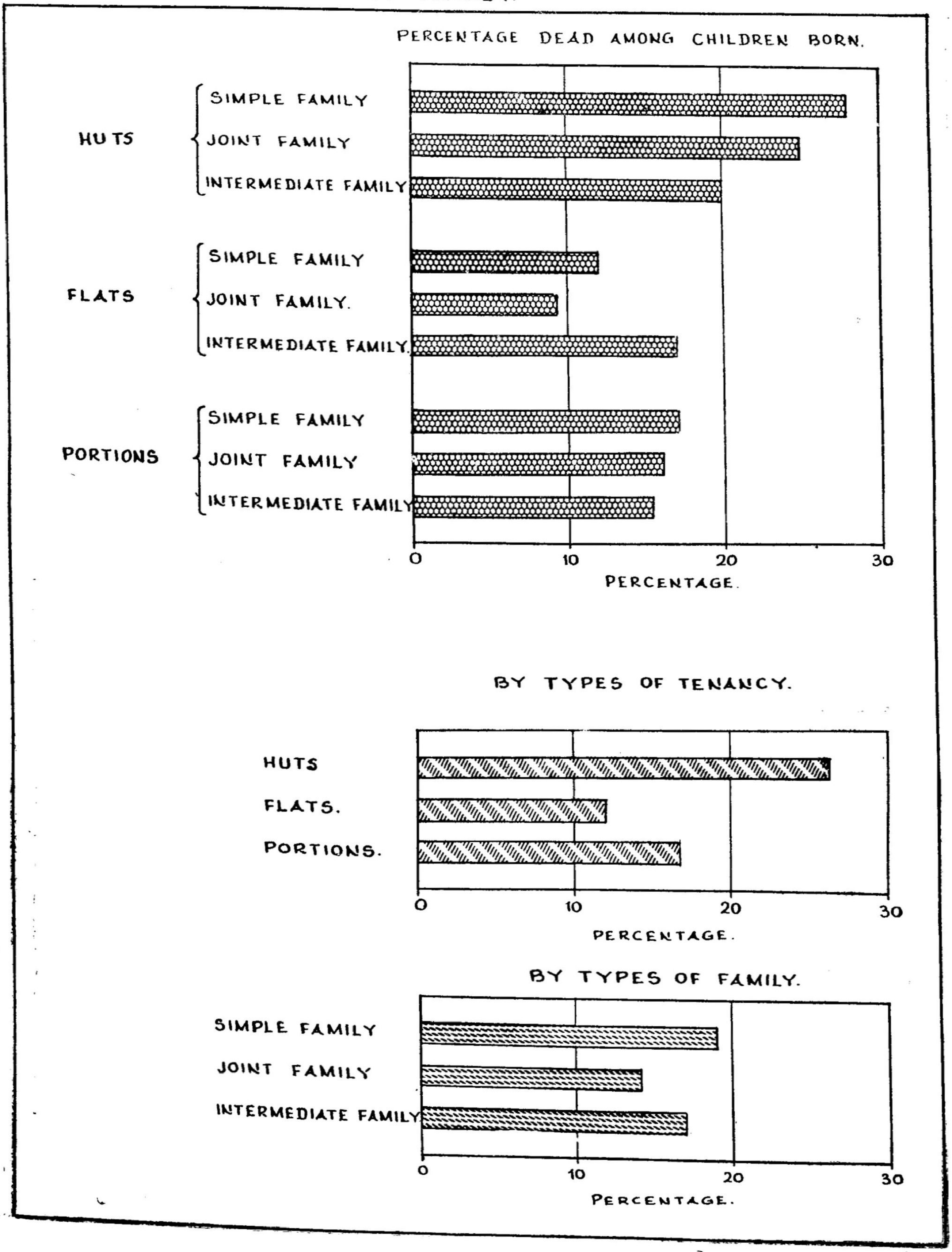
CASTE DIFFERENTIALS IN MORTALITY



DIFFERENTIALS IN MORTALITY BY EDUCATIONAL LEVEL OF FATHER



MORTALITY DIFFERENTIALS BY TYPES OF TENANCY & TYPES OF FAMILY.



others who have a level of living which is low when compared to that of persons living in independent houses or flats. The proportion of survivors among children born in this class is 83.4% and this is higher than the one prevailing in the class of people dwelling in huts. The hut dwellers have lost nearly one-fourth of the children born to them and this corroborates the evidence obtained from the Slum Survey carried out by this department, which shows that the death rate in slum areas is 50% higher than the death rate in non-slum areas. The pattern as between simple, joint and intermediate families has not been the same among the three types of tenancies considered. Among the hut dwellers, simple family has the lowest percentage of survivors and intermediate families experience the highest percentage of survival of children. Among those living in independent flats, persons of intermediate families have the lowest percentage of survivors and those of joint families the highest. In the third category *viz.*, persons sharing their houses with others, there is little difference in the percentage of survivors as between the different types of families. If we consider the simple, joint and intermediate families for all tenancies the following figures emerge :

Type of family	Percentage of Survivors
Simple family ...	81.1
Joint family ...	86.0
Intermediate family ...	83.2

The joint family seems to offer a better prospect of survival to children born, probably because there are more persons to bestow their attention on the children. Viewed in the background that fewer children are born in the joint families, this seems to reveal that fewer children and more members to bestow attention on them have together contributed to a higher rate of survival of children in the joint families.

Occupational status of household and mortality

That there is an association between social level and the rate of survival has been recognised in recent years. The Registrar-General of England and Wales has distinguished five social classes, *viz.*,

(i) Professional etc. occupations
(ii) Intermediate between I and III
(iii) Skilled workers
(iv) Intermediate between III and IV
(v) Unskilled workers.

The socio-economic homogeneity of these groups is limited by the fact that whole occupational units only are assigned to a group irrespective of the circumstances of individual workers coded to that unit and by the fact that the assignment to social group is governed by the relative prestige of the occupation rather than by objective information of income etc., which in any case is lacking in the census or registration data. Nevertheless the social classes do affect a broad division of the occupied population by economic and social circumstances which, like the proverbial elephant, is more difficult to describe than to recognise. This is more so in India, where data on mortality are hardly available by social classes. Here an attempt has been made to fill the gap with the help of data derived from the Family Planning Survey. The occupational status of households in the above survey was determined by a joint consideration of occupation as well as income and may be roughly comparable with the social classes defined by the General Register Office. The percentages of survivors in each class based on the above survey are presented below :—

TABLE 7–4

Percentage of survivors among children by occupational status of household

Occupational status	Percentage of survivors	Percentage of dead
A. Executives having income above Rs. 1,000 per month ...	89.5	10.5
B. Upper middle class people having income between Rs. 400–1,000 per month	93.6	6.4
C. Lower middle class people having income in the range Rs. 100–400 per month	89.0	11.0
D. White collar workers getting income less than Rs. 100 per month	83.6	16.4
E. Salaried unskilled labourers getting income less than Rs. 100 per month	78.8	21.2
F. Individual manual workers ...	76.6	23.4
G. Skilled workers in factories and transportation	80.0	20.0
H. Petty traders	75.5	24.5
I. Dependents ...	79.4	20.6
J. Others (retired persons, rentiers, etc.)	83.5	16.5
All classes	82.2	17.8

We find that the percentage of survivors among children has ranged from 75.5 in class H to 93.6 in class B. We may broadly divide this range into three categories of high, medium and low mortality. The classes falling in each category are given in Table 7–5.

TABLE 7–5

Mortality level among social classes

Mortality level	Criteria	Social classes
High	Percentage of survivors, less than 80%.	E. Salaried unskilled labourers getting income less than Rs. 100 per mensem.
		F. Individual manual workers.
		G. Skilled workers in factories & transportation.
		H. Petty Traders.
		I. Dependents.
Medium	... Percentage of survivors, 80% to 85%.	D. White collar workers getting income less than Rs. 100 per mensem.
		J. Retired persons, rentiers, etc.
Low	... Percentage of survivors, over 85% ...	A. Executives having an income over Rs. 1,000 per mensem.
		B. Upper Middle Class people having income between Rs. 400 and Rs. 1,000 per mensem.
		C. Lower Middle Class people having income in the range Rs. 100–400.

There appears to be a close association between social class and mortality, the better the social class the lower being the mortality. Even though this table does not give a picture of the level of mortality in each occupational class, the table nevertheless helps us to understand the differentials in mortality between the different classes.

Duration of marriage and mortality of children

That there has been a decline in mortality over a period of 30 years will be evident from a comparison of the percentage of survivors among children born to varying marriage duration, given in Table 7–6.

TABLE 7–6

Percentage of survivors among children born to women of varying durations of marriage

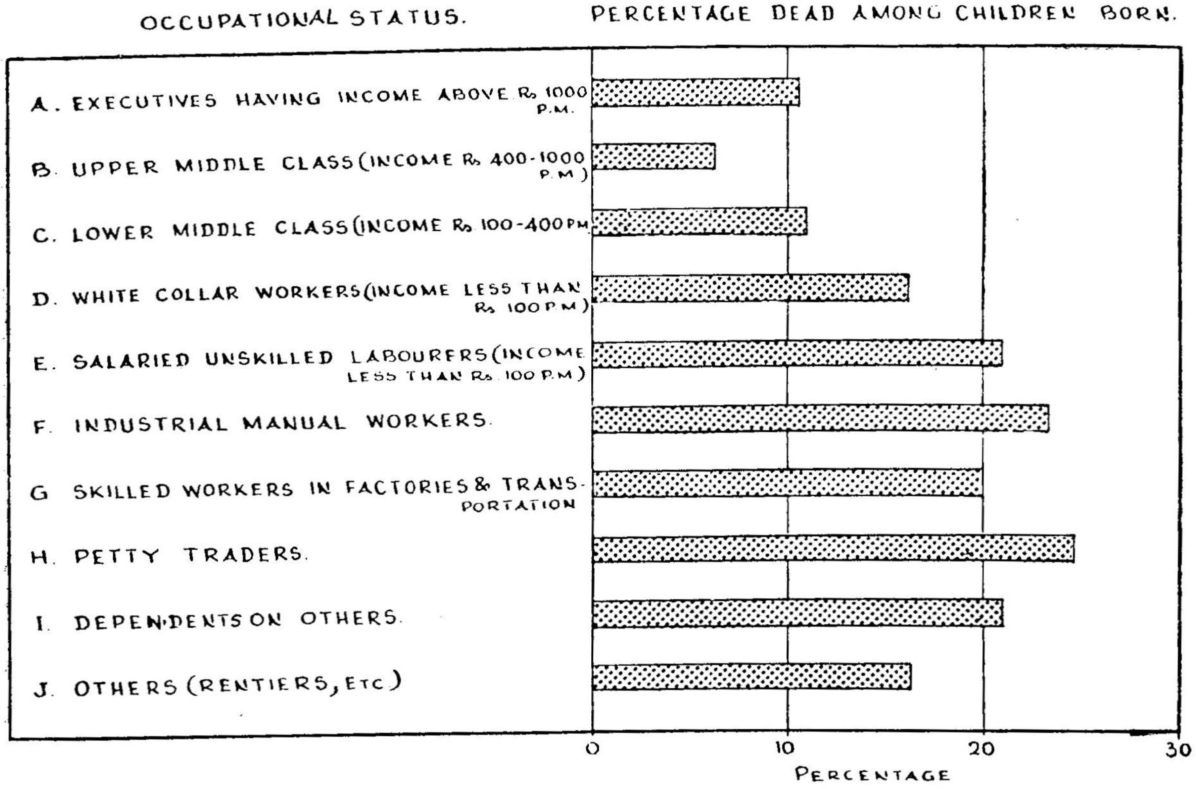
Duration of marriage years		Percentage of survivors	Percentage of dead
Below one	...	100.0	...
1— 4	...	90.6	9.4
5— 9	...	88.9	11.1
10—14	...	84.8	15.2
15—29	...	80.6	19.4
30 and above	...	76.4	23.6
All durations	...	82.2	17.8

We notice a steady fall in the percentage of survivors as duration is increased, which may be partly due to the fact that fewer children are born to women married recently and they have a greater chance of survival than that of the children born to women who were married earlier. This table reflects the improvement in public health that has taken place over the period under consideration and the consequent reduction in mortality rather than an influence of married life on the children born.

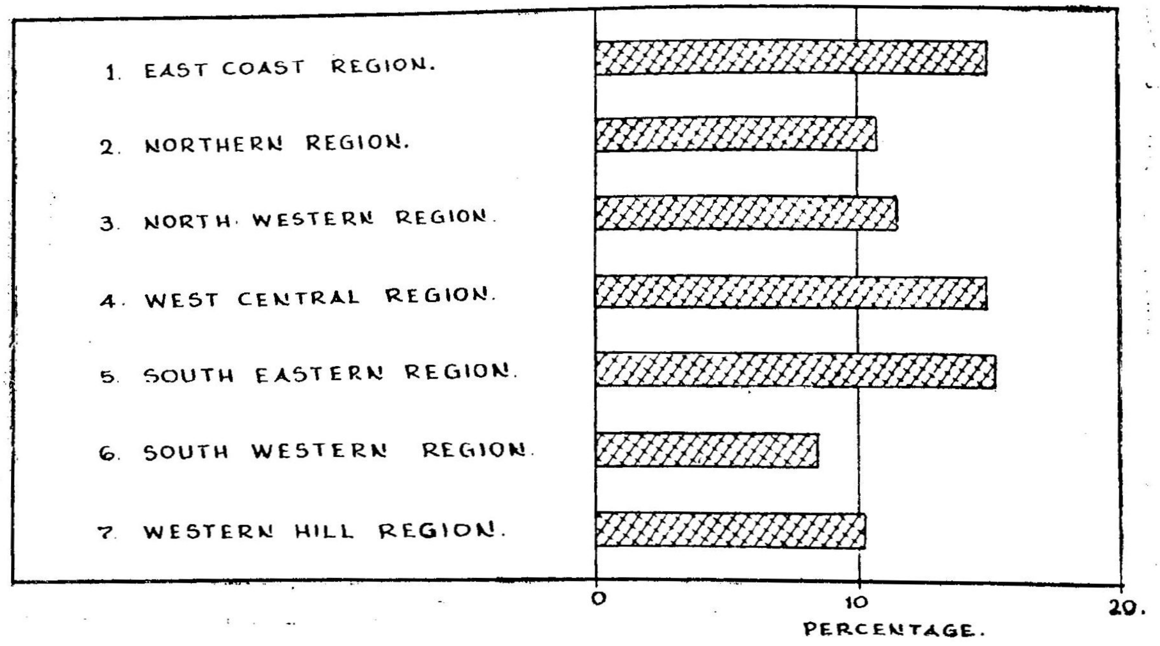
Housing Conditions

Another factor affecting the health of the people is the condition of houses which operates mainly through its influence in the spread of infectious diseases. The more a household is crowded into small or few rooms the greater the opportunity for infection to spread by droplet or by direct contact from one to the other. This increase in the facility of transmission of infection is even greater when the bed rooms have to be shared by the members of the same family or where rooms are used both for living and sleeping ; it is also greater, especially for diarrhoea diseases, where more than one

DIFFERENTIALS IN MORTALITY BY OCCUPATIONAL STATUS.



MORTALITY RATE BY AGRO-CLIMATIC REGIONS.



family are compelled to share the same sanitary arrangements (water closets or washing facilities).

For the first time in Indian census, the 1961 Census made an enquiry into the housing conditions as a part of the houselisting operations. Information was elicited on such items as material of roof, material of wall, size of household, number of rooms etc., for each category of census house. There are 66 lakhs of houses used as dwellings in 1961 in the State of which 50 lakhs are in rural areas. The distribution of households by the number of rooms is given in Table 7–7.

TABLE 7–7

Distribution of households by number of rooms

Rooms	Percentage of households		
	Total	Rural	Urban
No regular room ...	3.8	4.7	1.2
One room ...	65.6	67.5	59.7
Two rooms ...	18.7	17.7	21.7
Three rooms ...	5.8	4.9	8.5
Four rooms ...	2.6	2.0	4.3
Five and more rooms ...	2.1	1.5	4.1
Rooms not stated ...	1.4	1.7	0.5
Total ...	100.0	100.0	100.0

TABLE 7–8

Statistics of housing condition in Madras State

Districts	Rural Urban	No. of persons per room*	No. of persons per house-hold	Average No. of persons per household in					Per 1,000 Census households	
				1 room house-hold	2 room-house-hold	3 room-house-hold	4 room-house-hold	5 & more rooms household	With mud walls	With thatched roofs
Madras ...	U	2.92	4.91	4.22	5.49	6.35	6.87	9.61	255	310
Chingleput ...	R	3.28	4.68	4.27	5.36	5.98	6.91	8.21	788	785
	U	2.54	4.72	4.01	4.96	5.66	6.37	8.22	467	395
North Arcot ...	R	3.26	4.89	4.42	5.50	6.33	6.91	7.97	760	738
	U	2.66	5.16	4.33	5.46	6.22	7.00	7.50	462	378
South Arcot ...	R	3.39	4.64	4.31	5.33	5.95	6.94	7.61	834	848
	U	2.88	4.73	4.11	5.50	5.46	6.62	7.58	545	565
Salem ...	R	3.46	4.66	4.36	5.39	6.15	6.61	7.91	789	707
	U	2.95	5.08	4.37	5.48	6.19	6.69	9.82	504	328
Coimbatore ...	R	3.17	4.57	4.23	5.11	5.77	6.37	6.99	643	318
	U	2.69	4.71	4.12	5.17	5.77	6.26	7.36	361	142
Nilgiris ...	R	2.07	4.63	3.89	4.59	5.22	6.03	6.08	90	127
	U	2.09	4.60	3.64	4.98	5.46	6.04	6.35	104	107
Madurai ...	R	3.12	4.52	4.11	5.15	5.83	6.49	7.53	790	571
	U	2.99	4.80	4.15	5.26	6.07	6.97	10.65	469	311
Tiruchirapalli ...	R	3.31	4.35	4.10	5.19	5.50	6.26	6.59	832	771
	U	2.68	4.59	3.99	5.06	5.68	6.28	7.62	413	425
Thanjavur ...	R	3.58	4.36	4.17	5.24	5.62	6.24	7.39	757	780
	U	3.01	4.66	4.14	5.23	5.98	6.85	8.85	455	483
Ramanathapuram ...	R	3.29	4.54	4.31	4.91	5.58	6.17	7.48	791	612
	U	2.68	4.62	4.07	5.07	5.37	5.95	8.00	425	304
Tirunelveli ...	R	2.55	4.31	3.95	4.60	4.98	5.34	5.77	617	543
	U	2.17	4.37	3.90	4.45	4.97	5.31	5.66	312	285
Kanyakumari ...	R	2.20	5.13	4.33	5.20	5.59	5.85	6.52	283	576
	U	2.07	5.15	4.31	5.14	5.53	5.89	6.64	139	269
State ...	R	3.17	4.57	4.23	5.16	5.71	6.31	7.09	742	664
	U	2.70	4.76	4.13	5.17	5.77	6.39	8.04	385	325
All India ...	R	2.58	5.19	4.40	5.25	6.02	6.71	8.14	569	460
	U	2.61	5.08	4.17	5.38	6.19	6.92	8.58	215	200

* Excludes persons with no room.

Source : E-V-2 and E-IV-1 & 2 of Part IV-B : Housing and Establishment Tables.

One room tenements constitute the major proportion (65.6%) with two room tenements ranking next with 18.7% of the households. Nearly 3.8% of households do not have any regular rooms. The average number of persons per household in the State is 4.62 with 4.57 in rural and 4.76 in urban areas. The overall density of occupation is 3.03 persons per room with 3.17 persons per room in rural and 2.70 persons per room in urban areas. The figures for each category of tenements are given in Table 7-9.

TABLE 7-9

Number of persons per room

Rooms	Number of persons per room		
	Total	Rural	Urban
One room ...	4.21	4.23	4.13
Two rooms ...	2.58	2.58	2.58
Three rooms ...	1.91	1.90	1.92
Four rooms ...	1.59	1.58	1.60
Five and more rooms ...	1.16	1.11	1.21
All categories ...	3.03	3.17	2.70

The number of persons per room varies from 2.18 in Kanyakumari district to 3.45 in Thanjavur district. Though no data were collected on the availability of pipe water, water closets, etc., it is likely that the proportion of households having such amenities will be very small. It is difficult to assess the influence of this factor on the general health conditions in the State with the limited data available to us.

Practice of contraception

The practice of contraception also seems to have an association with the percentage of survivors among children born. This may be an indirect association as those who favour contraception are the classes who are better educated and are also comparatively better off than those not adopting contraception, and generally the well to do and educated classes have a lower mortality rate than the other classes. The following figures seem to indicate such a tendency.

TABLE 7-10

Percentage of survivors among children born by contraception usage

Details	Percentage of survivors	Percentage of dead
Practising contraception ...	87.0	13.0
Not " " ...	81.4	18.6
All classes ...	82.2	17.8

The Family Planning Survey has revealed that the proportion of married women practising contraception is very small (10.4 %) and as yet this factor is not likely to be of great significance in the general health situation. But in due course when contraception becomes more widespread, families will be able to bestow more attention on the few children they beget and with better attention, a greater longevity is bound to follow.

Density of population

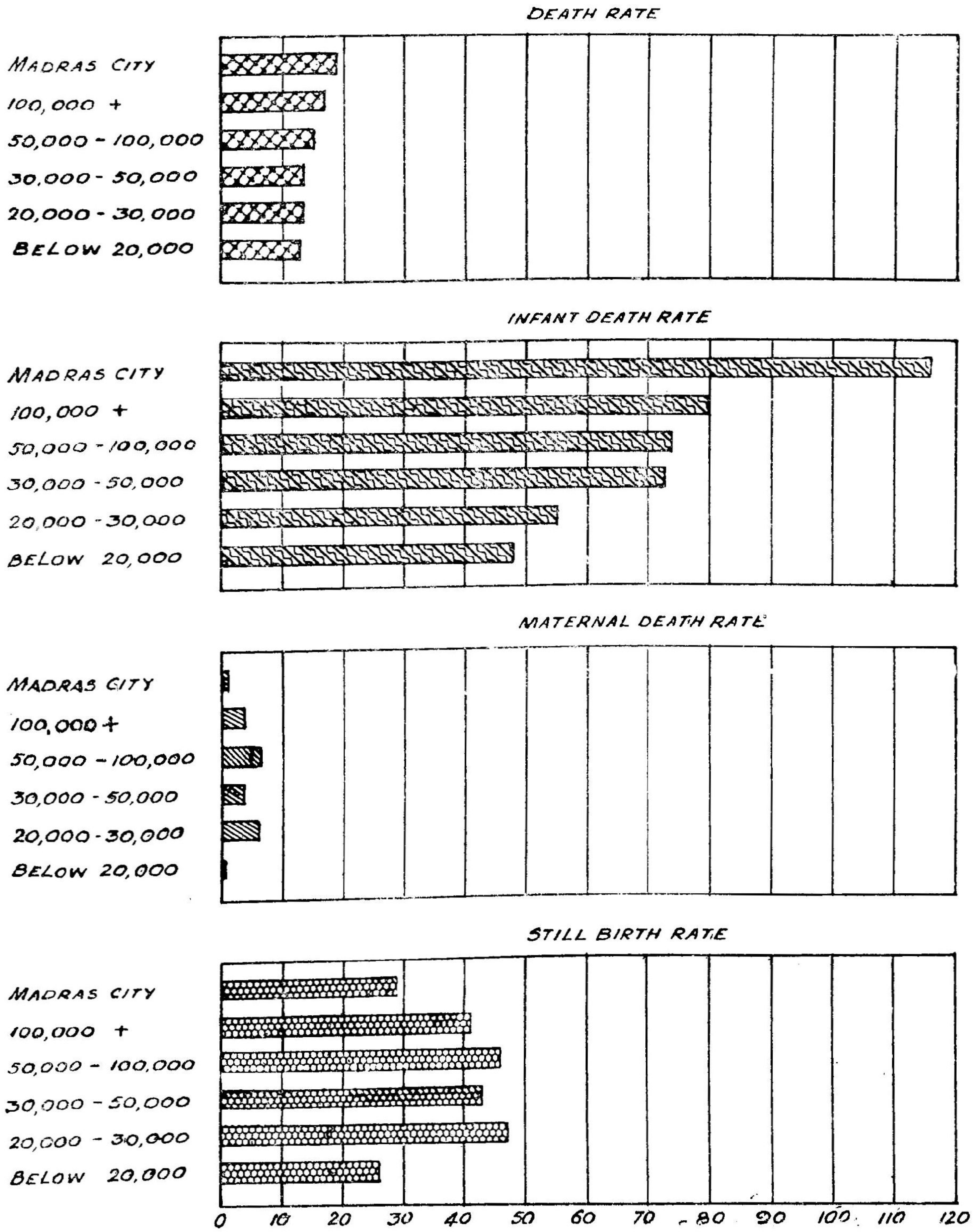
The experience of countries like the U.K. and the U.S.A. has shown that one of the greatest influences militating against health in the past has been the increasing gravitation of the population of the crowded cities. By 1851, above half the population of England and Wales had come to live in towns. In 1921, only 20.7% of the population remained in rural districts and in 1951 this proportion had fallen to 19.2%. In 1951 two-fifths of the population of England and Wales were concentrated in the six major conurbations (the term given to certain large agglomerations of urban areas which represent towns that have outgrown their administrative boundaries). In earlier days when the process of town expansion was unregulated, town life was associated with many inimical factors—streets instead of fields ; unsatisfactory dwellings instead of country cottages ; dust and belching smoke and noise instead of sunshine, clean air and quiet ; a preponderance of indoor occupations ; crowding together of the population with enhanced opportunities for the transmission of infectious disease ; bad drainage and risk of contamination of water supplies ; and importation of food from areas far distant from sources of supply and consequently, increased opportunities for its infection and decay. Many of these conditions are not true of India since urbanisation on such a scale has not taken place, and the towns are only administrative and commercial centres. That there exists an association between the death rate and the size of the towns is evident from the following figures of death, infant death and still-birth rates by size of urban area for 1961.

TABLE 7-11

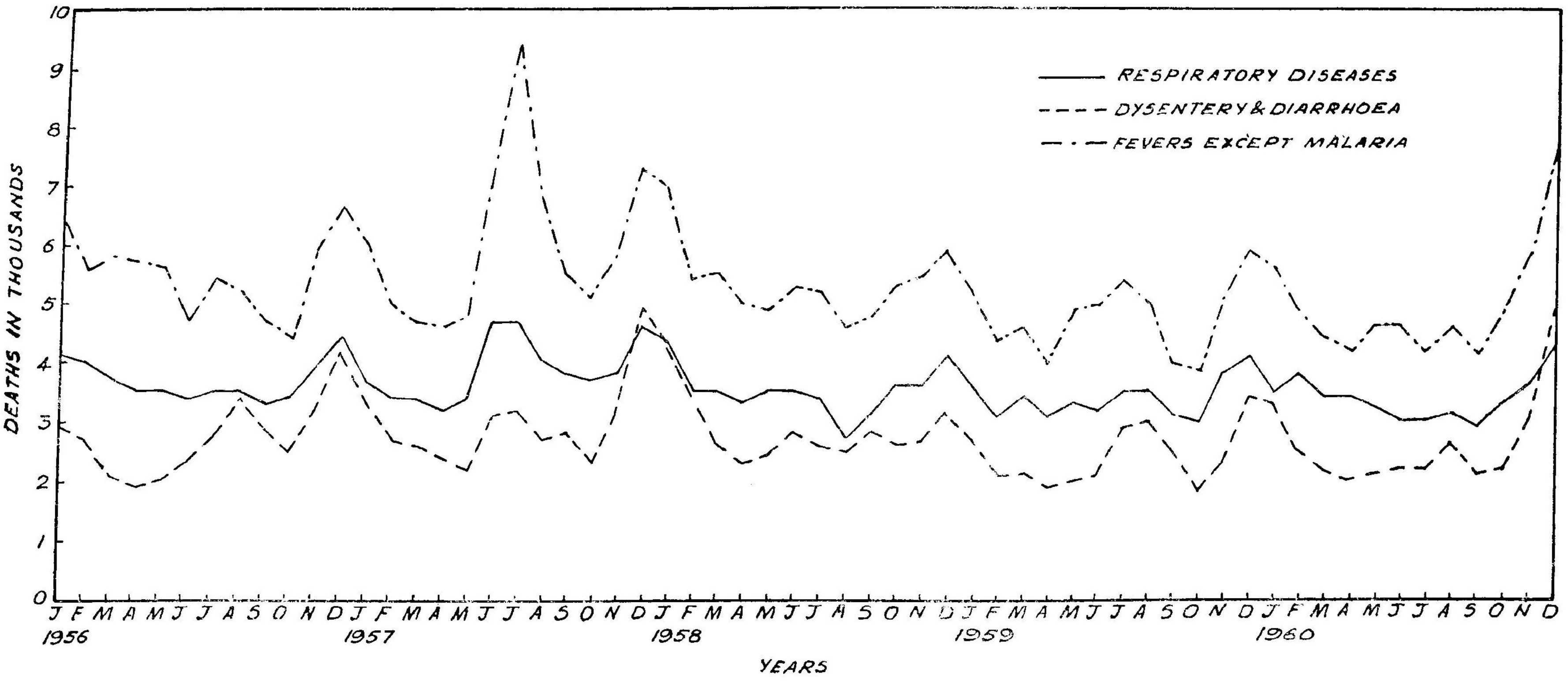
Death, infant death and still-birth rates by size of municipal towns, 1961

Size of municipal area	Death rate	Infant death rate	Maternal death rate	Still-birth rate
Metropolitan city of Madras ...	18.8	115.8	1.1	28.6
Above 100,000 ...	16.6	80.2	4.3	41.3
50,000—100,000 ...	14.9	73.3	5.7	46.2
30,000—50,000 ...	13.9	72.2	4.2	43.4
20,000— 30,000 ...	14.1	55.0	5.6	46.8
Below 20,000 ...	12.8	47.8	0.2	26.3

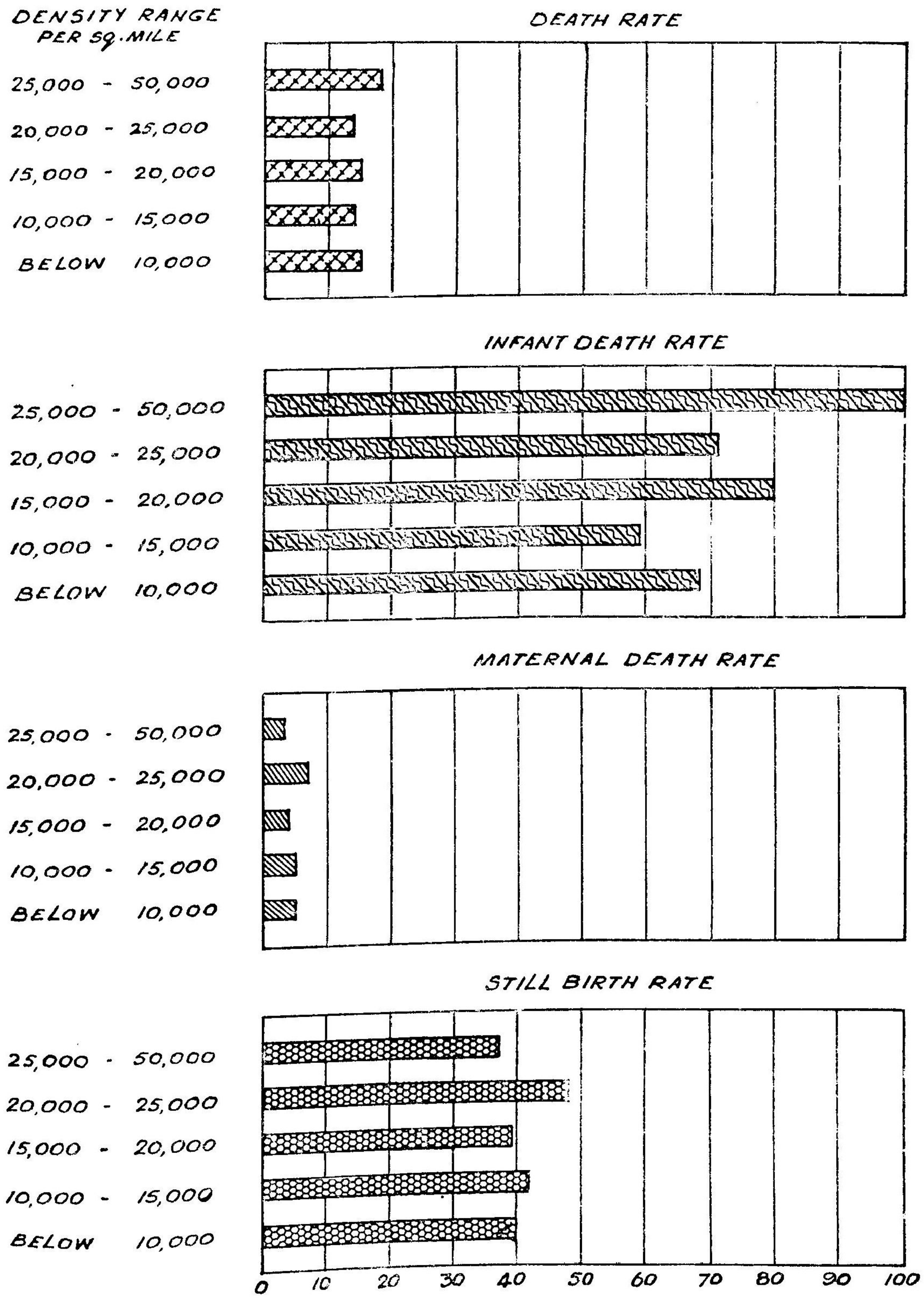
DEATH, INFANT DEATH AND STILL BIRTH RATES BY SIZE OF MUNICIPAL TOWNS, 1961



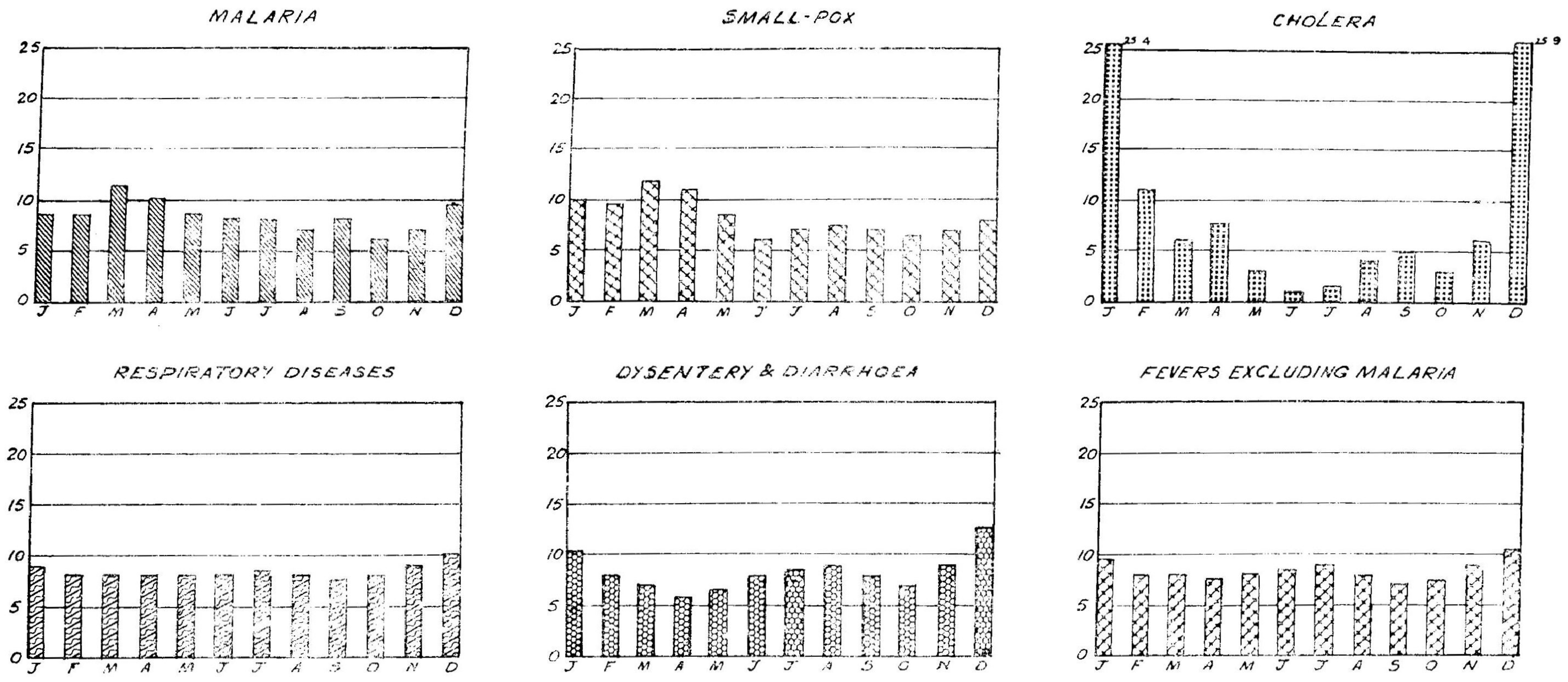
MONTHWISE STATISTICS OF DEATHS FROM DIFFERENT CAUSES, 1956-1960



DEATH, INFANT DEATH, MATERNAL DEATH & STILL BIRTH RATES BY DENSITY RANGES OF MUNICIPAL AREAS, 1961



MONTHWISE PERCENTAGE OF DEATHS BY CAUSES, 1956-60



A more proper approach for comparison will be to standardise the rates for possible differences in age-sex distribution, but in the absence of death rates by age groups for the different areas, we have to content ourselves with the above review. There has been some controversy among demographers as to whether there is any direct relationship between population and density of population as such *viz.*, as measured by the number of persons per square mile of the area in which they are resident. Farr (1843) found an approximate arithmetical equality between the ratio of the death rates of two areas and the sixth root of the density of population but he himself was doubtful of any implied law. Newsholme (1891) himself showed that the relationship did not provide a basis for predicting the mortality in large tenement blocks. It has since become abundantly clear that ill-health springs not simply from the closeness with which people live together but from a whole complex of social and economic factors which may be associated with such crowding. One measure of overcrowding is the density of population, and the municipalities of Madras State have been classified by the density ranges with a view to studying the variations in death rate with variations in density. The following are the death, infant death and still-birth rates in different density ranges.

TABLE 7–12

Death, infant death, maternal death and still birth rates by density ranges of municipal areas *

Density range per sq. mile	Death rate	Infant death rate	Maternal death rate	Still-birth rate
25,000—50,000 ...	18.0	100.3	2.6	36.6
20,000—25,000 ...	14.0	70.6	6.5	48.2
15,000—20,000 ...	14.5	79.7	3.7	38.9
10,000—15,000 ...	14.3	59.4	5.1	42.3
Below 10,000 ...	14.5	68.4	4.7	40.1

* Based on data for only 56 Municipalities.

From these figures it is not possible to conclude that there are differentials in death rate by size of municipality. But it appears that towns in the density range 25,000 to 50,000 have a definitely higher death and infant death rates than the remaining density ranges. It is difficult to disentangle the separate influence of particular elements in the general complex of social conditions, since these elements are all interdependent. Those who can afford an expensive house can also afford to be well fed and well clothed, and by the same token are rarely in dirty or unhealthy occupations; they are usually well educated and know how to take care of their health. One condition implies all the others.

Climate

The influence of climate can only be separated with difficulty from that of other conditions of environment. Climate has a marked influence on the prevalence of particular diseases, *e.g.* malaria where high temperature is needed for effective multiplication of the vectors of infection. Diptheria and scarlet fever prevail little in tropical countries. The prevalence of tuberculosis in some tropical areas is not a product of climate but of other social factors coupled with racial susceptibility or lack of immunological protection.

The registered deaths for each month for the period 1956–60 shows that dysentery and diarrhoea have their peak in December-January, and trough in April-May. The deaths due to respiratory diseases reach their maximum again in December-January, whereas they are at their minimum in September, April and May. Cholera is again at its height in December-January and in June-July, few deaths due to Cholera occur. Malaria mortality is heavy in March-April whereas it is at its lowest in September-October. Small-pox takes a heavy toll of human lives in January to April than in the remaining months. Fevers other than malaria have a heavier toll in December and January. This gives a broad picture of the seasonal variations in mortality. A proper understanding of the seasonality of various diseases will help the formulation of adequate measures at the appropriate periods of the year and the avoidance of wastage of limited resources.

TABLE 7–13

Monthwise percentage of deaths by causes, 1956–60

Months	Malaria	Small-pox	Cholera	Respiratory diseases	Dysentery and Diarrhoea	Fevers excluding Malaria
January ...	8.5	10.0	25.4	9.0	10.2	9.4
February...	8.5	9.6	11.3	8.3	8.3	7.9
March ...	11.5	11.8	5.8	8.1	7.2	7.8
April ...	9.9	10.8	7.5	7.7	6.4	7.4
May ...	8.5	8.6	3.3	7.9	6.6	7.8
June ...	7.9	5.9	1.2	8.3	7.7	8.4
July ...	7.8	7.1	1.4	8.4	8.4	9.2
August ...	7.1	7.6	4.1	7.9	8.8	8.2
September.	7.7	7.1	5.0	7.6	8.0	7.3
October ...	6.3	6.7	2.8	8.0	7.1	7.4
November..	6.9	6.8	6.3	8.8	8.8	8.8
December..	9.4	8.0	25.9	10.0	12.5	10.4
Total ...	100.0	100.0	100.0	100.0	100.0	100.0

Proportional Mortality Ratio (PMR)

Vital and health statistics provide the basic material for formulating judgements about the state of health of a country and its different regions. In fact the search for suitable indices of health has engaged the attention of the statisticians since the time of Graunt, and is likely to continue for several years. The suggested indices are either of a comprehensive type covering all aspects of public health or of a specific nature such as the Proportional Mortality Ratio (PMR), the expectation of life (e_x^0), or the crude death rate. The PMR defined by Swaroop as the number of deaths at age fifty and over as a percentage of total deaths, is the most recent addition. If everyone survives to the age of 50, the proposed index would be 100, and if no one does, it would be zero. We have computed the Proportional Mortality Index for different districts and the figures are shown in Table 7–14.

TABLE 7–14

Proportional Mortality Ratio (PMR) for Rural and Urban Areas

Districts		Total	Rural	Urban
Madras	...	26.64	...	26.64
Chingleput	...	33.59	33.40	34.62
North Arcot	...	31.76	32.44	29.15
South Arcot	...	34.00	33.71	36.24
Salem	...	39.50	39.57	39.18
Coimbatore	...	35.50	38.02	29.09
Nilgiris	...	25.13	24.10	26.57
Madurai	...	30.24	31.26	28.20
Tiruchirapalli	...	38.20	38.75	35.68
Thanjavur	...	39.63	40.14	37.95
Ramanathapuram	...	34.36	35.24	32.49
Tirunelveli	...	33.49	33.15	34.42
Kanyakumari	...	43.57	44.55	41.18
State	...	34.38	35.65	31.25

It appears from this table that mortality is low in rural areas when compared to urban areas. This is not likely to be true as may be seen from the discussion in the subsequent sections. Similarly it is well-known that the death rate of Madras City is higher when compared to other districts due to the unhealthy living conditions in the slums. On the contrary the PMR gives a picture of good health in Madras City. It is, therefore, likely that the errors in the death registration are of such magnitude that the PMR gives a totally distorted picture of the mortality situation in the different districts. Therefore the question of finding an alternative index of mortality differentials has engaged our attention and the results of our modest attempt are set out in the following sections.

Differential Mortality Index (DMI)

Based on principles similar to those that were employed for computing the Differential Fertility Index (DFI) in an earlier Chapter, we have suggested an Index of differential mortality. The object of this index is to compare the mortality level of a local area with that of the State, with the data that may be regarded as fairly accurate. The Death Rate itself is subject to serious omissions and cannot be employed for working out such an index. The infant mortality rate is the rate of two items *viz.*, infant deaths and live-births. Each of these is found to be under registered, but luckily the extent of under-registration of infant deaths as well as live births is likely to be fairly balanced. These errors are likely to cancel each other or leave the rate somewhat on the low side. The latter is more likely in the rural areas.

Fortunately, we find that the rural infant mortality rate is higher than the urban infant mortality rate. This is the case in spite of an under-estimation of the rural rate and this brings out poignantly that the rural mortality level is definitely higher than that of the urban area. For the purpose of the computation of an index of differential mortality (DMI) we may assume that the degree of undercount will be more or less equal in all districts. If this can be assumed, then the Infant Mortality Rate for a local area 'i' can be expressed as a ratio of that of the State to obtain the index as follows:

$$\text{DMI} = \frac{(\text{IMR})\ i}{\text{IMR}} \times 100$$

The computed values of DMI are shown in Table 7–15. We notice that the index is above 100 for Madras, Chingleput, North Arcot, South Arcot and Tirunelveli districts and less than 100 in Salem, Coimbatore, Nilgiris, Madurai, Tiruchirapalli, Thanjavur, Ramanathapuram and Kanyakumari districts. The highest

TABLE 7-15

Computation of Differential Mortality Index (DMI) for Rural and Urban Areas

District	T R U	Births 1951-60	Infant deaths 1951-60	IMR. 1951-60	DMI.
1. Madras ...	T	653,190	95,256	146	136
	R	...	...	...	...
	U	653,190	95,256	146	136
2. Chingleput ...	T	529,441	66,468	126	118
	R	433,317	55,951	129	121
	U	96,124	10,517	109	102
3. North Arcot...	T	950,382	108,207	114	107
	R	740,422	86,207	116	108
	U	209,960	22,000	105	98
4. South Arcot...	T	733,004	79,870	109	102
	R	613,682	70,396	115	107
	U	119,322	9,474	79	74
5. Salem ...	T	840,192	80,142	95	89
	R	693,320	68,672	99	93
	U	146,872	11,470	78	73
6. Coimbatore ..	T	865,349	82,934	96	90
	R	592,548	57,951	98	92
	U	272,801	24,983	92	86
7. Nilgiris ...	T	108,202	10,006	92	86
	R	68,409	6,327	92	86
	U	39,793	3,679	92	86
8. Madurai ...	T	834,625	86,572	104	97
	R	525,706	55,182	105	98
	U	308,919	31,390	102	95
9. Tiruchirapalli.	T	776,805	80,630	104	97
	R	588,459	65,742	112	105
	U	188,346	14,888	79	74
10. Thanjavur ...	T	792,722	81,337	103	96
	R	549,778	62,779	114	107
	U	242,944	18,558	76	71
11. Ramanatha-puram.	T	590,577	53,817	91	85
	R	398,423	36,283	91	85
	U	192,154	17,534	91	85
12. Tirunelveli ...	T	792,341	93,354	118	110
	R	561,509	66,881	119	111
	U	230,832	26,473	115	107
13. Kanyakumari.	T	210,759	12,769	61	57
	R	158,937	9,579	60	56
	U	51,822	3,190	62	58
State ...	T	8,677,589	931,362	107	100
	R	5,924,510	641,950	108	101
	U	2,753,079	289,412	105	98

Note.—DMI is obtained by expressing the IMR as a percentage of the Infant Mortality Rate for the State, 107.

recorded index (136) is found in the case of Madras City and the least (57) in the case of Kanyakumari district. Generally the rural infant mortality is higher than the urban infant mortality, but the difference is small in the case of Nilgiris, Madurai, Ramanathapuram and Kanyakumari districts.

The rural mortality level is highest in Chingleput district (121) closely followed by Tirunelveli (111) whereas the least mortality level is found in Kanyakumari district (56). Next to Madras City, Tirunelveli district has the highest level of urban mortality. The rural-urban differential is large in the case of Thanjavur, Tiruchirapalli and South Arcot districts but the difference is not significant at the State level.

If the death rate for the State is known it will be possible to arrive at the death rates for each district and also for the rural and urban areas of each district. We have already shown that the death rate of Madras State in 1951-60 may be around 20 per 1,000 persons. Applying the DMI to this death rate we have computed the death rate for rural and urban areas of each district.

TABLE 7-16

Estimated death rates by districts, 1951-60

District		Total	Rural	Urban
Madras	...	27.2	...	27.2
Chingleput	...	23.6	24.2	20.4
North Arcot	...	21.4	21.6	19.6
South Arcot	...	20.4	21.4	14.8
Salem	...	17.8	18.6	14.6
Coimbatore	...	18.0	18.4	17.2
Nilgiris	...	17.2	17.2	17.2
Madurai	...	19.4	19.6	19.0
Tiruchirapalli	...	19.4	21.0	14.8
Thanjavur	...	19.2	21.4	14.2
Ramanathapuram	...	17.0	17.0	17.0
Tirunelveli	...	22.0	22.2	21.4
Kanyakumari	...	11.4	11.2	11.6
State	...	20.0	20.2	19.6

Geographical variations in mortality

The geographical variations are very often the result of environmental factors which vary from area to area. For instance, rainfall has been comparatively heavy in the State in the districts of Nilgiris, Coimbatore, Madurai, Tirunelveli and Kanyakumari, particularly in the plains below the western ghats.

Rainfall is found to be an important factor in spreading several infectious diseases like Cholera, Dysentery and Diarrhoea and other water-borne diseases. Broadly, the periods of the year can be classified under the following :

(i) The hot dry period—Mid-February to the end of March.

(ii) Period of the hot weather showers—Beginning of April to Mid-June.

(iii) Transition to south-west monsoon rains—Second half of June.

(iv) The period of the south-west monsoon rains—Second half of June.

(v) The rainy period of the retreating monsoon—Mid-October to Mid-December.

(vi) The cold transition period between the rainy period and the dry period—Mid-December to Mid-January.

(vii) The cold dry period—Mid-January to Mid-February.

In general, the temperature rises rapidly from January through the months of February and March to a maximum in April, May or June, after which it falls gradually till the month of September. With the burst of the retreating monsoon in October, the temperatures begin to fall more rapidly and this rate of fall continues till December. Relative humidity is higher on the coastal areas than in the interior and higher in the months of October to February than in the summer months. On an average, it is at a minimum in June and maximum in January. At the coastal stations a single maximum (in December or January) alone is reached. At these stations, as the dry season sets in later than December, the added effects of precipitation and low temperature result in maximum humidity in December and January. But at the interior stations double maxima, one in October or November and the other in January are generally attained. At these latter stations the first maximum in October or November is due to the burst of the retreating monsoon. This is followed by a minimum in December when the dry season sets in at these interior stations. The second maximum in January is, of course, due to the night temperatures, being lowest in January. How far the temperature, rainfall and relative humidity affect the mortality picture, it is difficult to interpret. However, it appears that the period of hot weather showers and the rainy period of the retreating monsoons are marked by fewer deaths whereas the number of deaths is the highest in the cold transition period *viz.*, December and January.

It is all the more difficult to draw inference regarding the comparative health picture of different districts, because the registration efficiency in all the districts has not been uniform throughout. However, we cannot dismiss the data altogether. The data together with considerations such as endemicity of each district to different infections, density, rainfall and climatic factors should help us to draw an inference which may be regarded as an intelligent guess of the situation. Table 7-17 presents the data which are of help in such a comparative analysis.

TABLE 7-17

Evidences regarding Geographic variations in the death rate

Districts	Registered death rate, 1951-60			Registered Infant Mortality Rate, 1951-60	Ad hoc Census of rural areas, 1962		Death Rate per lakh of population				Density of population per sq. mile
	Total	Rural	Urban		Range of Death Rate	Mean Death Rate	Cholera	Malaria	Small-pox	Dysentery & Diarrhoea	
Madras ...	23.5	...	23.5	145.8	...	...	6.6	4.7	178.3	308.6	35,339
Chingleput ...	14.9	15.0	14.5	125.5	15.7-17.3	16.5	2.3	19.4	73.5	109.0	696
North Arcot ...	15.8	15.6	16.7	113.9	12.1-19.2	16.1	1.7	18.6	36.9	178.1	671
South Arcot ...	13.6	13.6	13.6	109.0	13.7-23.8	17.6	3.9	7.2	49.2	98.0	724
Salem ...	10.7	10.5	11.9	95.4	9.3-14.1	11.0	1.6	45.1	43.5	56.7	539
Coimbatore ...	11.4	10.5	14.9	95.8	8.2-12.9	11.1	2.4	15.6	36.1	84.9	590
Nilgiris ...	10.2	8.9	13.8	92.5	7.7-11.7	9.9	...	19.7	21.3	59.9	417
Madurai ...	13.8	12.8	16.4	103.7	10.3-16.4	13.3	2.7	9.3	22.7	80.5	660
Tiruchirapalli ...	15.7	15.8	15.1	103.8	10.0-17.6	14.4	4.4	15.9	26.3	71.8	579
Thanjavur ...	14.3	13.8	16.8	102.6	10.4-16.7	14.2	8.5	8.4	46.3	51.1	868
Ramanathapuram.	13.6	13.1	15.1	91.1	9.3-18.0	13.0	0.8	13.6	28.0	84.7	502
Tirunelveli ...	16.7	17.7	14.6	117.8	15.0-25.6	18.6	4.5	8.8	20.8	88.6	619
Kanyakumari ...	8.5	8.1	9.8	60.6	10.4-14.6	12.7	0.2	2.5	22.9	104.1	1,544
State ...	14.2	13.4	16.7	107.3	7.7-23.8	14.0	3.4	15.8	44.3	100.1	672

TABLE 7-18

Death Rate by Agro-Climatic Regions, 1951–60

Agro-Climatic Regions	District names	Rainfall conditions	Irrigational facilities	Cropping pattern	Death rate
1. East Coast Region.	Chingleput, North Arcot, South Arcot and Tanjore.	Here normal annual rainfall is above 1,000 mm. Retreating monsoon (Oct.—Jan.) rainfall is high (above 900 mm). Advancing monsoon (June—Sept.) rain is low (below 400 mm).	About 58% of net sown area is irrigated. Canal irrigation assumes exceptional importance in agriculture of Tanjore district (94% of the net area irrigated by canals). Tank irrigation is predominant in other districts.	Paddy is the predominant crop. Oilseeds and millets are subsidiary crops.	14.6
2. Northern Region.	Salem District ...	Annual rainfall is between 800–900 mm. June—September rainfall is medium (400–600 mm), October—January rainfall is low (200–400 mm).	About 20% of the net sown area is irrigated. Well irrigation accounts for more than 50% of the total irrigated areas.	Millet is the predominant crop. Pulses and oilseeds are subsidiary crops.	10.7
3. North-western Region.	Coimbatore district.	Annual rainfall is between 600–800 mm. Rainfall for both retreating and advancing monsoons is below 400 mm.	About 29% of the net sown area is irrigated. Well irrigation is more predominant.	Millet is the major crop. Oilseeds, cotton and pulses are subsidiary crops.	11.4
4. West Central Region.	Tiruchirapalli and Madurai districts.	Annual rainfall is between 700–900 mm. Rainfall for both the retreating and advancing monsoons is moderately low (400–600 mm).	About 30% of the net sown area is irrigated by tanks, canals and wells.	Millet is the staple crop. Rice, pulses and cotton are subsidiary crops.	14.7
5. South-eastern Region.	Tirunelveli and Ramanathapuram districts.	Annual rainfall is below 900 mm. October—January rainfall is medium (400–600 mm), June—September rainfall is very low (below 125 mm).	About 37% of the net sown area is irrigated. Tank irrigation is overwhelmingly important, accounting for 95% of the net irrigated area.	Rice and millet are important. Rice is grown along the river by canal irrigation. Millet is, on the other hand, a non-irrigated crop. Cotton, oilseeds and pulses are subsidiary crops.	15.3
6. South-western Region.	Kanyakumari district.	Annual rainfall is about 1,000 mm.	About 50% of the net sown area is irrigated. Tank irrigation is practised.	Paddy is the predominant crop. Fruits, vegetables and cocoanuts are subsidiary crops.	8.5
7. Western Hill Region.	Nilgiris district, Palni taluk of Madurai district.	Annual rainfall is above 1,000 mm.	Only 1% of the net sown area is irrigated.	Tea and coffee are the predominant crops. Vegetables, millets and paddy are subsidiary crops.	10.2

Kanyakumari appears to be the healthiest district in the State. This is mainly due to the better housing condition in this district which has reduced the chances of infection. Kanyakumari has few deaths due to small-pox and still fewer deaths of Cholera and dysentery and diarrhoea. Ramanathapuram district stands next in the matter of health. Cholera mortality is very low in this district and this is perhaps, one reason for a low death rate in this district, but this factor alone cannot explain a low death rate.

It appears that Nilgiris district stands out as the third healthy district. This district has an affable climate and barring a few malarial areas like Gudalur, a very healthy and salubrious atmosphere prevails. The district is free from Cholera and has fewer deaths from Small-pox and Dysentery and Diarrhoea. The next position is occupied by Coimbatore and Salem districts. The common feature of these districts is that they border western ghats. In the case of Salem, there are fewer deaths due to Cholera, Dysentery and Diarrhoea. Coimbatore district has a more salubrious climate and this district has relatively fewer cases of respiratory diseases.

Madras, Chingleput, North Arcot, and Tirunelveli have the highest death rates when compared to the remaining districts. The high death rate can be mainly attributed to Cholera, Dysentery and Diarrhoea and in Madras and Chingleput due to a high mortality from Small-pox. The high death rate found in Madras City is due to the unhealthy living conditions in the slums which cover nearly one-fifth of the population of the city in 1961. The slum survey ,has shown that the unhygienic conditions in the slums are also responsible for higher death rate in the City.

The State may be broadly classified into 7 Agro-Climatic regions by superimposing rainfall regions on the crop distribution picture of the State. Each of the regions shows some peculiar characteristics because of its distinctive rainfall conditions and irrigation pattern. In Table 7-18 we have given the death rate for each region and this provides a comparison of the health situation in the different regions, even though this may not enable us to infer the extent to which the agro-climatic conditions are responsible for such variations. It appears that the south-eastern regions consisting of Ramanathapuram and Tirunelveli districts have the highest death rate. The south-western regions which consist of Kanyakumari District and the western hill region consisting of Nilgiris District have the lowest death rates.

In conclusion, we wish to suggest that the study of occupational mortality will assume importance as the pace of industrialisation gets accelerated and skills become more and more localised. The attempt made in this Cnapter to study social class differentials is very rudimentary and has to be limited to the data available for Madras City from a special analysis of the Family Planning Survey data. As pointed out earlier, it is difficult to disentangle the separate influence of particular elements in the general complex of social conditions since these elements are all inter-dependent. Our first requisite is adequate and reliable data which is difficult to compile. Even in England, such difficulty is felt and Benjamin[1] has pointed out three possible sources of error:

(*a*) Vagueness of description of occupational or social classes.

(*b*) Lack of time reference.

(*c*) Difficulty of separation of specific occupation factors.

He has concluded : " Having regard to these difficulties it must be appreciated that the occupational mortality investigation associated with the Census is a very crude diagnostic tool, giving no exact or final answers but throwing into relief differentials worthy of closer study by more precise methods. In this way the investigations have proved of great value in the past. It is probable that in the future longitudinal studies (*viz.*, following up groups of workers throughout their period of employment) in particular industries under the close supervision of medical field workers will be more efficient in revealing true occupational risks. Such studies would not be confined to mortality risks but would embrace also sickness absence *i.e.*, they would begin at a point nearer the outset of the occupational influence on health." There is scope for research here to identify the important factors such as housing, socio-economic groups, urbanisation, etc., and we hope this report will stimulate interest in this direction.

[1] **Benjamin, B. Elements of Vital Statistics, p. 139.**

CHAPTER VIII

CONTROL OF INFECTIOUS DISEASES

Introduction

Many of the infectious diseases occurring today were known as far back as early antiquity. In the Book of Levites we can find an accurate information on leprosy ; the First Book of the Biblical Prophet, Samuel gives a description of a plague epidemic that struck the Philistines in 1120 B.C. In the *Bhagavata purana* a still older sacred book of India, we find not only a description of plague, but also indication that it is communicated by rats.

In olden days the communicable diseases were attributed to supernatural forces like demons and priests and magicians were called upon to exorcize the spirits or propitiate the Gods. The lepers were banished because of the obvious danger of contact with them. Ancient sacred books of India instructed the people to abandon their homes upon discovering rats dying *en masse* since sick rats often brought plague. References to the miasma of the Pontine swamps as the cause of malaria indicated the danger of living in malarial areas.

As human knowledge developed, the ideas about the nature of communicable diseases changed. In 1546, the Italian physician Fracastro expressed his belief that communicable diseases were caused by pathogenic organisms. In the 17th Century, Sydenham supported this point of view, while Leewenhock was the first to see at about the same time, microscopical organisms—animalcula—to which the ability to cause decay and contamination were ascribed. By the 19th Century the theory that communicable disease was caused by infection became dominant in medicine.

Only after the brilliant discoveries of Pasteur and his followers was it finally established that the various infectious diseases were caused by different microscopic organisms specific for each disease. Pasteur not only conclusively proved the microbial nature of communicable diseases but also elaborated methods of controlling them by developing vaccines from attenuated microbes. He furnished scientific proof in support of the observations made by Jenner, the creator of the first vaccine. Pasteur's great discoveries began the bacteriological era in the study of infectious diseases. Scarcely 100 years have elapsed since his first studies in microbiology; more has been done during this period than during all of man's preceding history.

These researches were continued by others and further began to be put into practice on a large scale. The antirabic vaccine developed by Pasteur began to be used on a large scale as a reliable method of saving people from rabies. Lister introduced antisepsis in surgical operations and this was later supplemented by asepsis as a result of which the terrible epidemics of hospital gasceous gangerene, post-operative suppuration and puerperal fever (sepsis) ceased to take a toll of thousands of lives. In Germany, Koch discovered the agent of Tuberculosis, and an offensive against this grave social disease was then started on the basis of scientific knowledge of its causes.

The rapid development of the science of microbiology in the 20th Century has led to the discovery of many etiologic agents of infectious diseases—typhus, yellow fever, poliomyelitis, small-pox and measles. The infective agent of influenza, one of the most widespread infectious diseases in the world, was discovered in 1933. New vaccines for typhoid, dysentery, cholera, diphtheria, yellow fever and plague made their appearance and new therapeutic serums and new chemical remedies for syphilis and malaria came into use. The sulpha drugs were discovered in the 1930's and the studies aimed at obtaining pencillin were completed by the early 1940's. These discoveries opened a new era in the treatment of infectious diseases by antibiotics. D.D.T., a reliable means for fighting insects, the vectors of infectious diseases, appeared at the same time. During the Second World War, new drugs for treating and preventing infectious diseases made it possible to prevent considerable losses from infectious diseases and grave epidemics which had invariably accompanied all past wars.

The post-war period has witnessed a decline in the incidence of infectious diseases and mortality throughout the world, owing to modern therapy and prophylaxis. Physicians are now devoting special attention to the virus infections about which not enough is known yet. A search for prophylactic vaccines and serums to control influenza is continuing and a vaccine for poliomyelitis was discovered by Salk in the 1950's. New methods of investigating viruses by means of electron microscope were developed and cultures of tissues grown outside the organism began to be used.

Epidemiology which has developed side by side with microbiology disclosed the laws governing the

spread of communicable diseases, ascertained the causes of epidemics and elaborated ways and means of controlling these diseases and measures for preventing and eradicating them. Standards of social and personal hygiene have been developed on the basis of the achievements of epidemiology, and international quarantine agreements preventing the spread of infectious diseases have been concluded. The infectious diseases hospitals have improved the methods of treatment. General biology and parasitology have come to the aid of medicine in understanding communicable diseases in man, leading to the science of medical parasitology which plays an important role in the study of the natural foci of contagious diseases.

The achievements of scientific medicine are of an international character—a result of the development of world science to which every country has made its contribution and every country has derived the benefit from the discoveries of others. However, it has not always been possible to fully utilise these developments in the control of such diseases. For instance, the method of controlling small-pox by means of vaccination was developed 150 years ago, but yet even today we hear of a large number of deaths due to small-pox every year. The causes of malaria and the mode of its propagation are well known and effective means of controlling it have been found 20 years back, but only recently this disease has been controlled in India. Scientific medicine has found out effective means of preventing and treating tuberculosis, but its control is rather difficult so long as living and dietary standards are low and medical facilities in the villages are lacking and the cost of the medicines are prohibitive.

Notification of diseases

Compulsory notification of infectious diseases was first introduced in England and Wales at Huddersfield in 1876. A year later following this example many other towns obtained powers to compel notification by local Act and in 1889 a general Act, the Infectious Diseases Notification Act was passed giving powers to local authorities to compel notification if required. This legislative achievement in England can be regarded as the culmination of a very long struggle which appears to have begun at least as early as the beginning of the eighteenth century, if not before.

This Act and the developments that followed in England have been the basis for similar enactments elsewhere including India. The Epidemic Diseases Act, 1897, provides for better prevention of the spread of dangerous epidemic diseases. The Government of India, by this Act, has the power to take special measures and prescribe temporary regulations if an outbreak of any dangerous disease is threatened. The Government of India by a special notification delegated to Local Governments and Administrations the power conferred by the Epidemic Diseases Act, 1897 for the purpose of preventing the outbreak of the spread of plague; but Local Governments had no power to apply the provisions of the Act to any other disease without the express sanction of the Government of India.

Two sets of plague regulations were formulated under this Act; one applies to the City of Madras only, and the other in force outside the Presidency Town. These regulations embody the special powers conferred on officers of the Government and other persons and the special obligations laid upon the public in connection with plague. Obstruction of the former or breach of the latter renders a person liable to prosecution and punishment under Section 186 of the Indian Penal Code. District and Municipal Health Officers were appointed as special plague officers under the regulations.

" Dangerous Disease " is defined in the preliminary chapter of the Madras City Municipal Act, 1919; but Schedule VI of the Madras District Municipalities Act, 1920 and the same schedule of the Local Boards Act, 1920 gives a list of " Dangerous Diseases " to which the sections of the Acts, dealing with prevention of disease refer. These diseases are anthrax, chicken-pox, cholera, diphtheria, enteric fever, glanders, leprosy, plague, small-pox and tuberculosis.

The Madras Public Health Act, 1939 (Madras Act III of 1939) defined the following as infectious diseases:

(*a*) acute influenzal pneumonia
(*b*) anthrax
(*c*) cerebro spinal fever
(*d*) chicken-pox
(*e*) cholera
(*f*) diphtheria
(*g*) enteric fever
(*h*) leprosy
(*i*) measles
(*j*) plague
(*k*) rabies
(*l*) relapsing fever
(*m*) scarlet fever
(*n*) small-pox
(*o*) tuberculosis
(*p*) typhus

The local authorities were empowered to take steps for the treatment of such infectious diseases and preventing it from spreading or for investigating the cause of such mortality that may occur and the Health Officers

were given powers to appoint additional staff and to obtain necessary medical supplies. The above Act defined the following diseases as notified diseases :

(*a*) cerebro spinal fever
(*b*) chicken-pox
(*c*) cholera
(*d*) diphtheria
(*e*) leprosy
(*f*) measles
(*g*) rabies
(*h*) scarlet fever
(*i*) small-pox
(*j*) typhus

Under this Act, the Health Officers were empowered to occupy houses to prevent the spread of infection.

" Every medical practitioner who, in the course of his practice becomes cognizant of the existence of any notified disease in any private or public dwelling other than a public hospital and every manager of any factory or public building, every keeper of a lodging house, every head of a family and every owner or occupier of a house, who knows or has reason to believe that any person in any premises under his management, control or occupation is suffering from, or has died of a notified disease shall if the case has not already been reported, give information of the same with the least practicable delay—(*a*) in municipal areas, to the executive authority, the Health Officer or a Sanitary Inspector, and (*b*) in non-municipal areas to the Health Officer, a Health or Sanitary Inspector or the village headman.

TABLE 8–1

Death rates from Cholera, Small-pox and Plague for Madras State

Year	Estimated mid-year population	Deaths due to			Death rates per 100,000 from		
		Cholera	Small-pox	Plague	Cholera	Small-pox	Plague
1921 ...	21,260,853	12,170	4,165	11,187	57.2	19.6	52.6
1922 ...	21,438,964	3,507	15,441	7,977	16.4	72.0	37.2
1923 ...	21,619,078	3,265	12,654	10,870	15.1	58.5	50.3
1924 ...	21,801,266	39,678	8,924	3,710	182.0	40.9	17.0
1925 ...	21,985,556	43,138	8,825	1,708	196.2	40.1	7.8
1926 ...	22,171,964	23,036	6,053	1,386	103.9	27.3	6.3
1927 ...	22,360,552	22,836	4,140	1,099	102.1	18.5	4.9
1928 ...	22,551,476	33,435	3,977	1,246	148.3	17.6	5.5
1929 ...	22,744,704	23,532	5,925	1,075	103.5	26.1	4.7
1930 ...	22,940,013	6,792	4,400	1,097	29.6	19.2	4.8
1931 ...	23,158,151	24,974	3,188	1,028	107.8	13.8	4.4
1932 ...	23,419,450	4,788	4,676	1,352	20.4	20.0	5.8
1933 ...	23,684,028	777	8,158	1,005	3.3	34.4	4.2
1934 ...	23,951,960	11,520	7,392	1,103	48.1	30.9	4.6
1935 ...	24,223,301	31,304	7,060	283	129.2	29.1	1.2

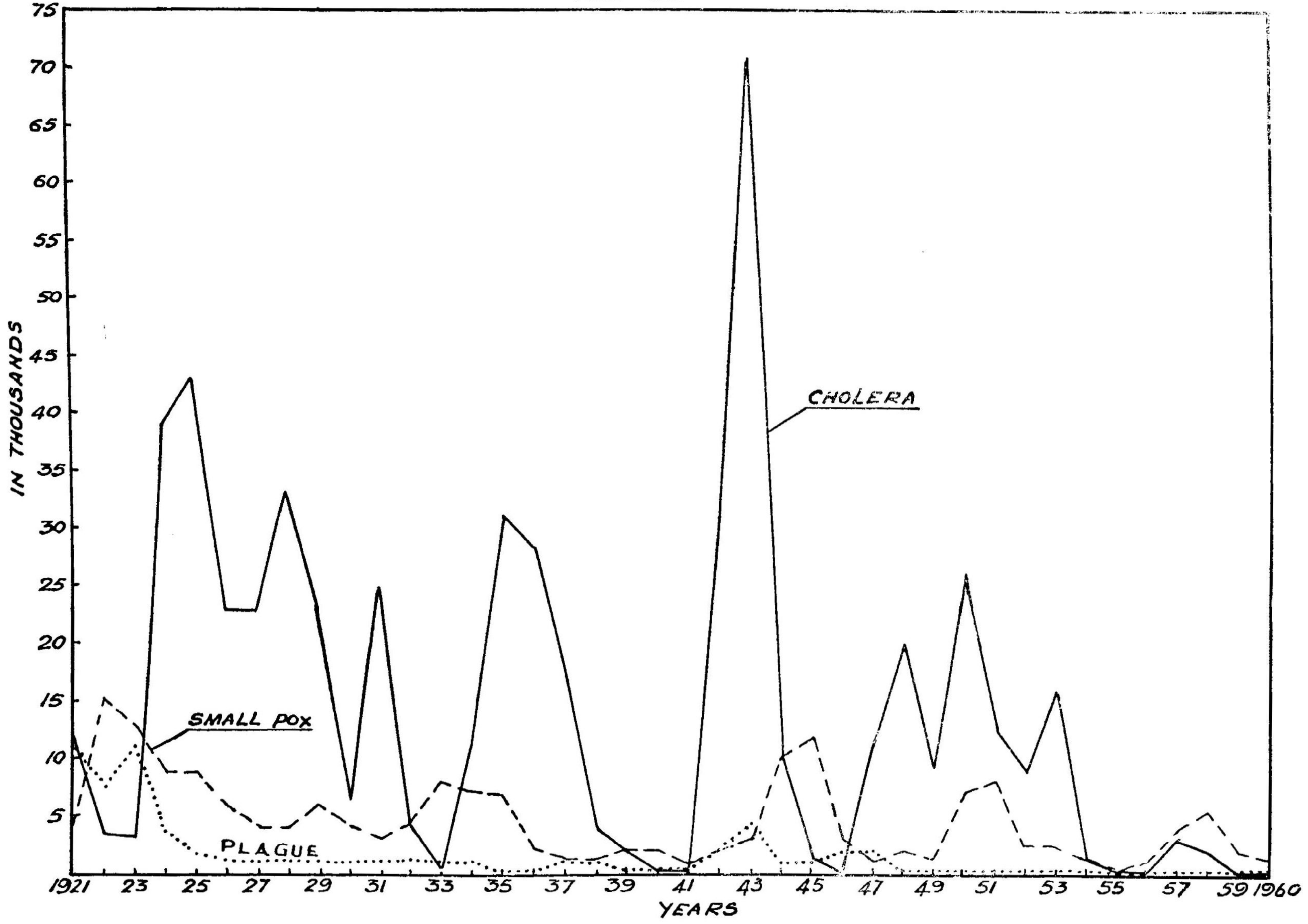
TABLE 8-1—(*Contd.*)

Death rates from Cholera, Small-pox and Plague for Madras State—(*Contd.*)

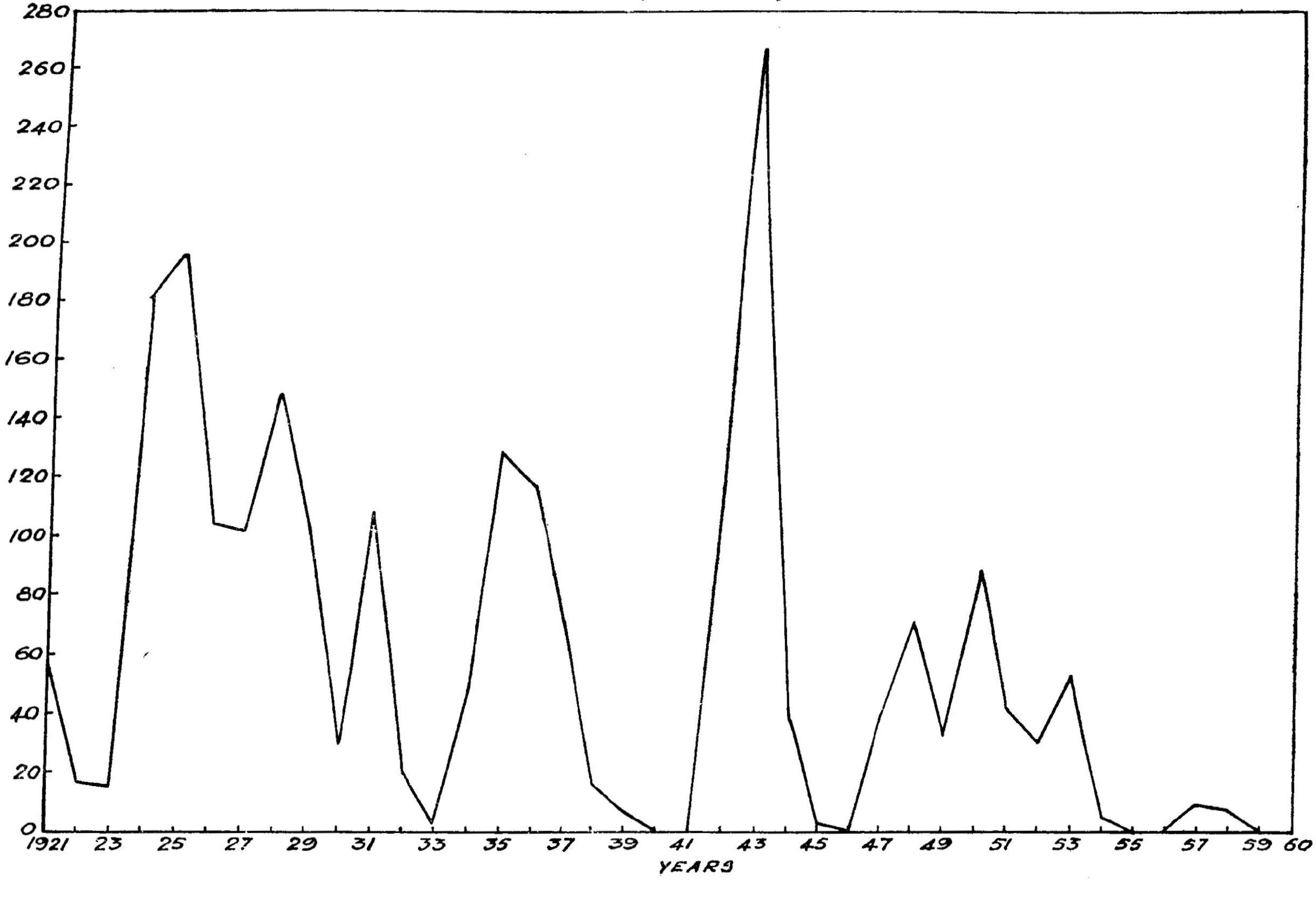
Year	Estimated mid-year population	Deaths due to			Death rates per 100,000 from		
		Cholera	Small-pox	Plague	Cholera	Small-pox	Plague
1936 ...	24,498,136	28,430	2,442	255	116.0	10.0	1.0
1937 ...	24,776,528	17,554	1,727	1,015	70.8	7.0	4.1
1938 ...	25,058,605	3,990	1,771	1,062	15.9	7.1	4.2
1939 ...	25,344,381	1,837	2,380	295	7.2	9.4	1.2
1940 ...	25,634,100	112	2,498	245	0.4	9.7	1.0
1941 ...	25,945,322	120	906	165	0.5	3.5	0.6
1942 ...	26,295,986	30,703	2,081	2,374	116.8	7.9	9.0
1943 ...	26,653,219	71,156	3,100	4,692	267.0	11.6	17.6
1944 ...	27,017,281	10,029	10,675	1,403	37.1	39.5	5.2
1945 ...	27,388,440	914	12,152	1,402	3.3	44.4	5.1
1946 ...	27,767,044	172	3,042	1,992	0.6	11.0	7.2
1947 ...	28,153,470	11,217	1,399	2,249	39.8	5.0	8.0
1948 ...	28,548,064	20,254	1,908	539	70.9	6.7	1.9
1949 ...	29,421,228	9,409	1,550	76	32.0	5.3	0.3
1950 ...	29,837,377	26,341	7,079	3	88.3	23.7	0.01
1951 ...	30,231,324	12,692	8,003	3	42.0	26.5	0.01
1952 ...	30,569,545	9,081	2,385	4	29.7	7.8	0.01
1953 ...	30,911,994	16,517	2,588	6	53.4	8.4	0.0
1954 ...	31,258,801	1,575	1,409	6	5.0	4.5	0.02
1955 ...	31,609,949	291	606	...	0.9	1.9	...
1956 ...	31,965,591	6	1,129	1	0.02	3.5	0.003
1957 ...	32,325,837	2,930	3,893	1	9.1	12.0	0.003
1958 ...	32,690,825	2,312	5,498	...	7.1	16.8	...
1959 ...	33,060,567	206	2,225	7	0.6	6.7	0.02
1960 ...	33,435,162	20	1,744	14	0.1	5.2	0.04

DEATHS DUE TO CHOLERA, SMALL POX AND PLAGUE

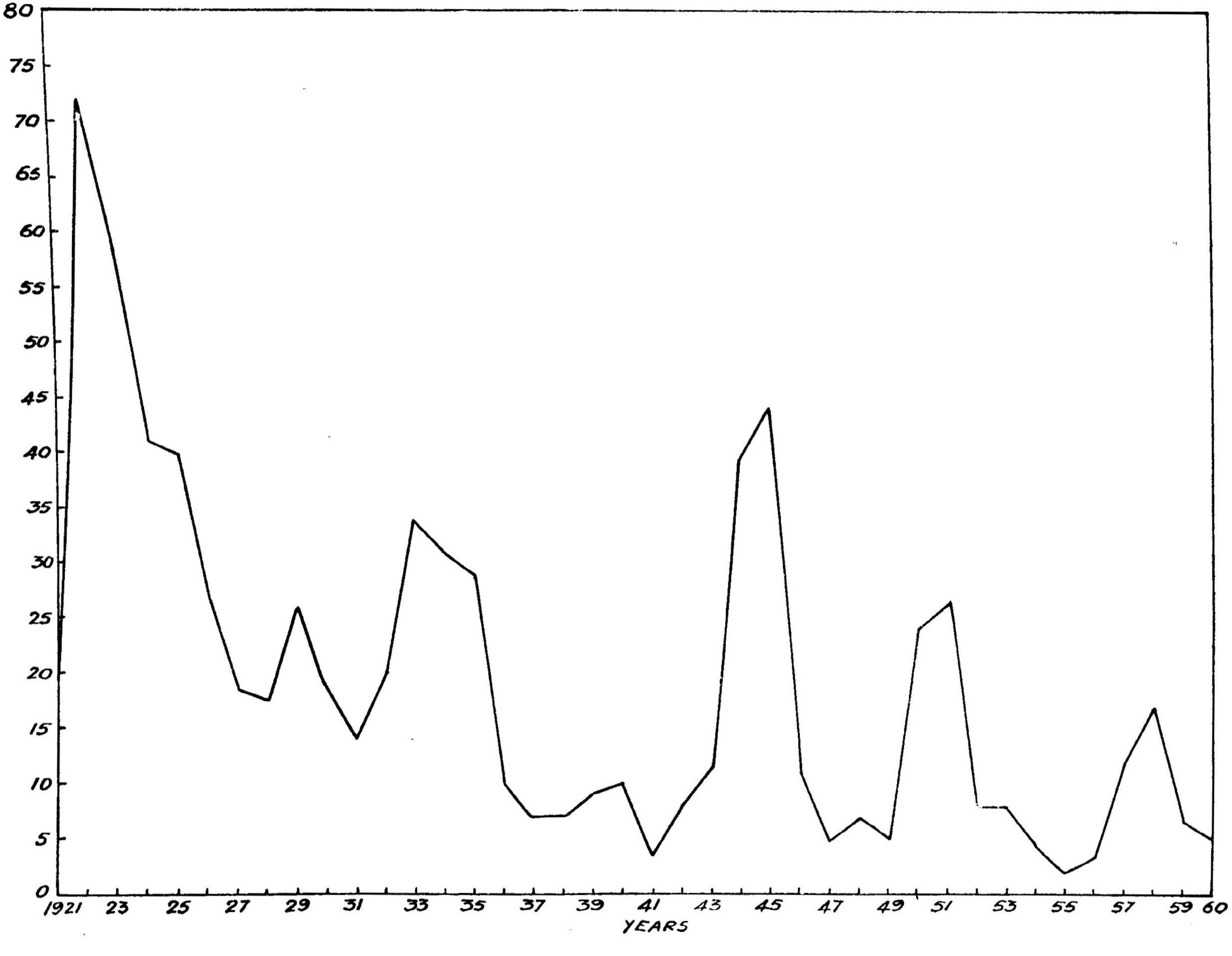
1921 - 60



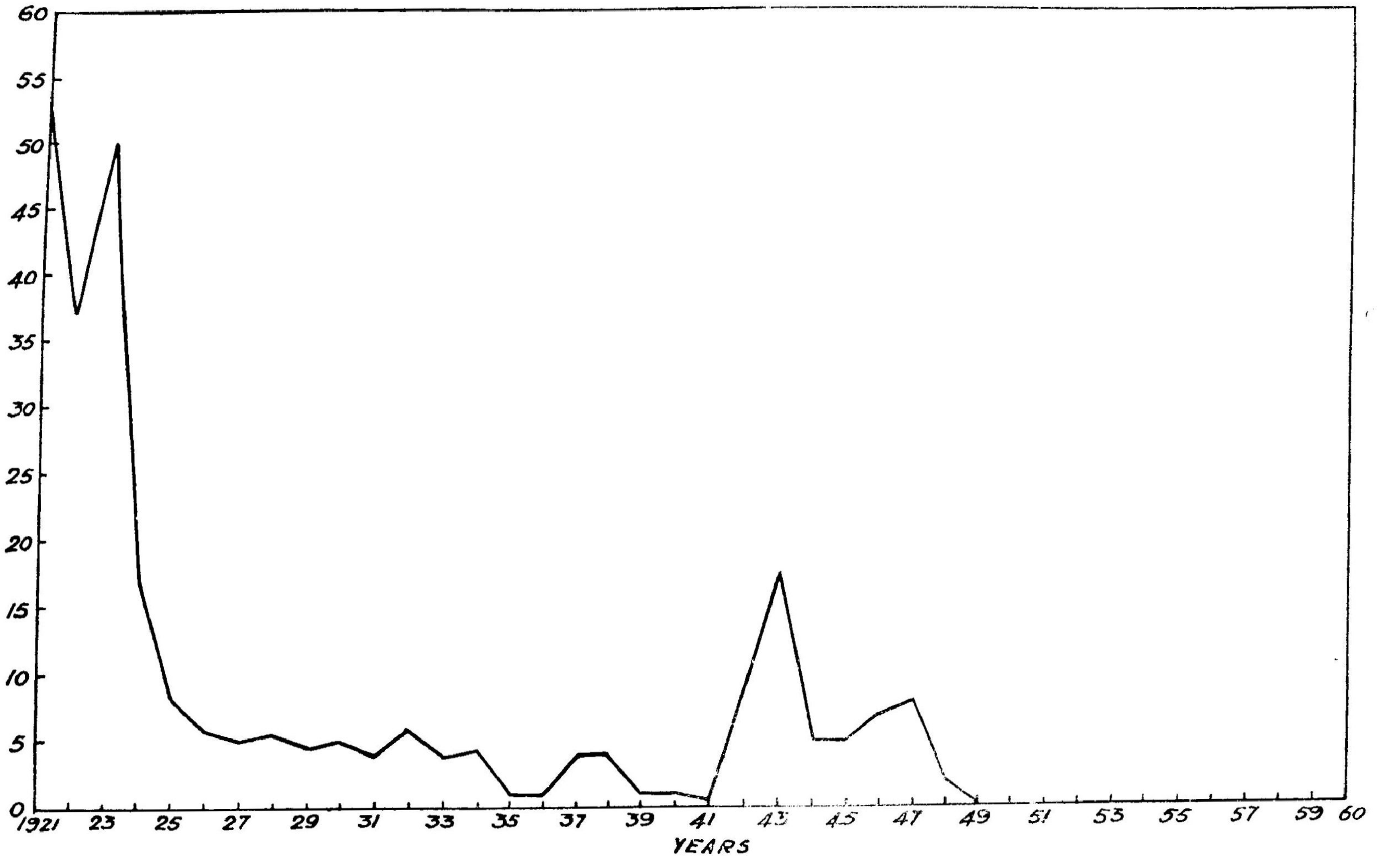
DEATH RATES FROM CHOLERA FOR MADRAS STATE, 1921-60
(PER LAKH)



DEATH RATES FROM SMALL-POX FOR MADRAS STATE, 1921-60
(PER LAKH)



DEATH RATES FROM PLAGUE FOR MADRAS STATE, 1921-60
(PER LAKH)



1. CHOLERA

Nature of the disease

Cholera is primarily a water-borne disease and in those areas which lie in the intersection of rivers and streams, the infection rapidly spreads down the river courses. This characteristic has been frequently noticed especially in the deltaic areas and the statistics show that the villages lying directly on the river banks, or on the banks of irrigation canals fed from the rivers are specially liable to infection. This makes it all the more important to conduct intensive preventive measures in such areas which lie in the conjunction of rivers and canals.

The cholera germ may be harboured by apparently healthy persons and many individuals after recovering from an attack continue to harbour the germ for varying periods. These "carriers" as they are called, are a grave menace, and represent potential foci for recurring outbreaks of the disease, as the excreta of these persons, at irregular intervals contain virulent cholera germs, and if these should by chance reach water or food, the disease is almost certain to appear.

When the carrier goes unchecked, as it happens in India, it is a very difficult problem to check the spread of infection. It is such carriers who are responsible for the outbreak of cholera at fairs and festivals. When thousands of people congregate and take bath in a tank or river, the presence of one or two carriers will suffice to spread the disease. When the drinking water of a community gets infected, the epidemic usually appears in an explosive form.

Vital Statistics of Cholera

The need for accurate statistics regarding the epidemiology of cholera can hardly be emphasised. The purpose of the data is to tell (1) when an outbreak is likely to occur, (2) where an outbreak is likely to occur, and (3) why an outbreak is likely to occur. An accurate record of cholera mortality together with ancillary enquiries of a local nature should help the health officials to trace the principal foci of cholera and take suitable action at the places where outbreaks are likely to occur. Such records should be accurate as regards the time and place of occurrence of the disease if they should prove useful in formulating control measures. The organisational set up is administered by an Assistant Director of Public Health, but the reports of attacks and deaths from cholera are often delayed in despatch and transmission, and a fortnight or month elapses before the reports reach the Office of the Director of Public Health. Sometimes the village officers wrongly report every case of sickness as due to cholera.

The delay in the reporting of the earliest occurrence of the disease results in the outbreak remaining unchecked until it has reached epidemic dimensions and all chance of tracing the original source of infection is lost. Provided that the village officers and tahsildars do their duty, a district health officer would become acquainted with the outbreak within a few hours of its occurrence and should be able to proceed at once to the town or village infected, and by his investigation to correct possible mistakes in diagnosis, to arrange for reports of all attacks and deaths to be promptly and accurately registered, and to decide what immediate measures are required and whether any concentration of health staff is required.

A picture of the extent of notification of cases of cholera in the State and deaths among the notifiable cases can be had from Table 8–2.

TABLE 8–2

Notified cases of Cholera and deaths, 1951–60

Year		Notified cases	Deaths	Percentage
1951	...	33,613	12,552	37.3
1952	...	29,993	9,081	30.3
1953	...	43,948	22,445	51.1
1954	...	3,917	1,592	40.6
1955	...	1,140	291	25.5
1956	...	29	6	20.7
1957	...	9,150	2,930	32.0
1958	...	6,508	2,312	35.5
1959	...	460	206	44.8
1960	...	26	20	76.9
1951–60—Total	...	128,784	51,435	39.9
Average	...	12,878	5,144	39.9

Table 8–2 shows that on an average there were 13,000 cases of cholera notified per annum during the last decade, of which the deaths numbered 5,000 per annum. The mortality worked out to be 40% of the notified cases. There have been fluctuations in the number of attacks as well as deaths and in the decennium under consideration the maximum was recorded in 1953. In the last two years there have been very few attacks as well as deaths.

Table 8-3 gives a comparative picture of the cholera death rate for each district for the period 1896-1926 and 1956-60.

TABLE 8-3

Mean death rate from Cholera, 1896-1960

District		1896-1926	1956-60	
			Average annual deaths	Rate (per lakh of persons)
Madras	...	91	108	6.59
Chingleput	...	101	49	2.30
North Arcot	...	115	51	1.66
South Arcot	...	188	115	3.87
Salem	...	132	59	1.60
Coimbatore	...	139	83	2.41
Nilgiris	...	...	...	...
Madurai	...	126	84	2.69
Tiruchirapalli	...	144	138	4.42
Thanjavur	...	257	268	8.44
Ramanathapuram	...	126	18	0.77
Tirunelveli	...	190	119	4.46
Kanyakumari	...	...	2	0.21
State	...	...	1,094	3.35

In the earlier period, we find that the mortality is heavy and no district has been immune from cholera ; Thanjavur, South Arcot and Tirunelveli were the worst affected. Further, a detailed examination of the monthly statistics available in the annual reports of the Director of Public Health shows that the incidence of cholera is much higher at some seasons of the year than at others, and if each district is taken as a separate unit, the periods of maximum intensity recur with as much regularity as the monsoon.

In the recent period (1956-60), we have a rate which is only one twentieth of the rate that prevailed half a century ago. This reduction has been mainly due to concerted efforts for the improvement of water supply and sanitation, expansion of preventive health staff and other measures that have been taken during this period. Today, cholera mortality is comparatively higher in the districts of Thanjavur, Madras, Tiruchirapalli and Tirunelveli than in the rest of the State. By an efficient system of epidemic control, it will be possible to totally eliminate cholera from the State.

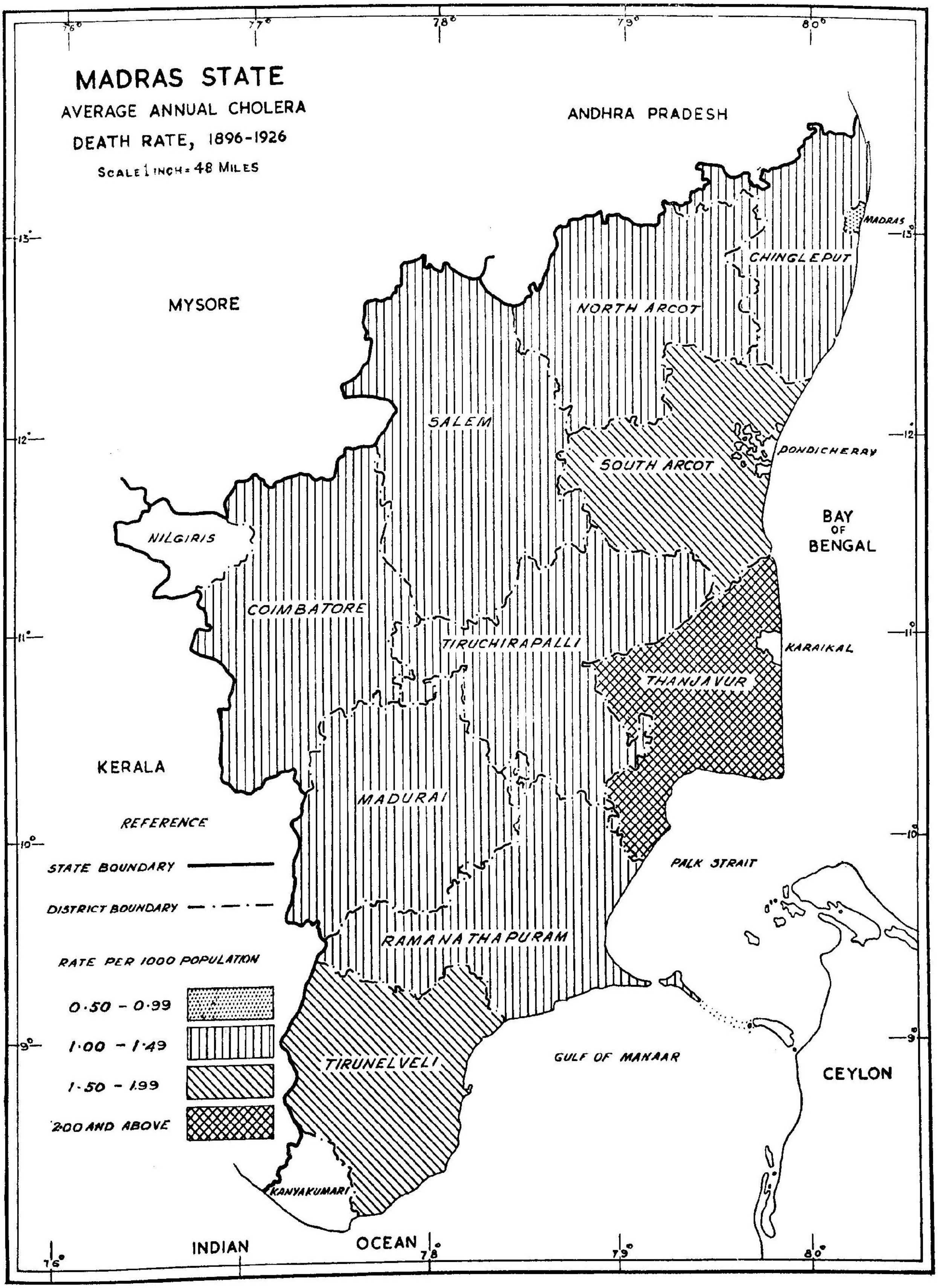
In India, unfortunately, the local bodies which are entrusted with the administration of public health rarely succeed in eliminating infection from the areas within their charge, and have in no case been able to establish immunity from re-infection from areas outside their jurisdiction. The reasons for this general failure are clear. Protected water supply is available only in a few places and preventive measures of a regular nature are totally wanting. The general practice has been to await the outbreak of an epidemic before deputing the staff to deal with it. The importance of the preventive aspect is hardly realised and the staff are often contented with the mere treatment of the cholera patients and the disinfection of drinking water supply. Such a procedure is the negation of preventive measures and little progress can be made in checking the depredations of this ubiquitous disease, unless the local bodies responsible can anticipate the outbreak of epidemics and prevent them.

2. PLAGUE

Nature of the disease

Plague is a disease of rats which can be communicated to men and to a few of the lower animals by bites of rat fleas which have fed on plague infected rats. If there were no rats or if rats could not readily obtain food and shelter in human dwellings, plague would disappear. The rat flea which carries plague cannot travel far on its own legs and is most commonly carried by the rat itself or by human beings or animals. Rats and fleas are frequently carried for long distances by road, train or ships, concealed in grain bags, baggage or clothing ; and man also sometimes carries the fleas on his person or clothing. In these ways infection spreads from district to district and even from province to province. We may recall the following observations of Norman White in 'Twenty Years of Plague in India' IJMR, Vol. VI, 1918-19.

"The chief interest attached to plague in Madras centres in the large proportion of that Presidency that has remained free from this disease throughout the twenty year period. But with few insignificant exceptions the whole of the eastern coastal districts have remained free from plague. This peculiarity is common to Orissa, most of Bengal and parts of Burma as well. Put in another form, rice growing India is plague-free India ; wheat growing India is essentially plague infested India. The writer is inclined to think that this is more than a coincidence. Rice growing India is rice eating India, and in general the amount of grains imported for consumption in such areas is relatively small. The facilities that the movement of grain offers for the transport of infection (in the form of infected rats and fleas) is now well recognised. Wheat growing India is grain exporting India, and in many cases large quantities of other grains are, or were imported into such areas, from infected tracks for home consumption.


MADRAS STATE
AVERAGE ANNUAL CHOLERA
DEATH RATE, 1896-1926
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
SOUTH ARCOT
PONDICHERRY
NILGIRIS
BAY OF BENGAL
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
KERALA
MADURAI
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
PALK STRAIT
RAMANATHAPURAM
RATE PER 1000 POPULATION
0·50 - 0·99
1·00 - 1·49
1·50 - 1·99
2·00 AND ABOVE
TIRUNELVELI
GULF OF MANAAR
CEYLON
KANYAKUMARI
INDIAN OCEAN
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°

Thus unusual facilities are offered for the "exchange" of plague infection. It is unlikely that these statements represent the whole truth, but that they are of considerable importance is open to but little doubt.

The only districts in Madras that have suffered at all severely from plague are Bellary, Coimbatore, Salem and Nilgiris, all districts bordering on Mysore that have suffered somewhat severely from plague. The first named district also adjoins severely infected districts of the Bombay, Deccan and of Hyderabad.

During the twenty year period plague has been the cause of 152,680 deaths in the Presidency. Never has the death rate approached unity for the Presidency as a whole. The recent epidemic was the most severe yet experienced when a plague death rate of 0.58 was recorded : 1911-12 comes second, 0.35 ; then 1903-04, 0.37 and 1904-05, 0.32.

The seasonal prevalence for the Presidency as a whole has been somewhat variable as one would expect from a variety of climatic conditions experienced in the few plague infected districts. January has been the month of maximum mortality followed by December and February. The mean daily incidence of plague mortality in these months is 45, 36 and 38. May and June have been the months of minimum plague mortality ; the mean daily mortality in these two months is 3 and 2 respectively."

TABLE 8-4

Plague mortality in India, 1898-1918

		Mean population 1901-11	Plague deaths	Percentage to all India	Rate per 1,000 of population
Madras	...	44,307,383	152,680	1.5	3.45
India	...	304,758,726	10,254,221	100.0	33.65

"The plague epidemic of 1917-18 yielded a mortality bill that has only thrice been exceeded since the disease was imported into Bombay in 1896." "Severe outbreaks of plague have been more especially during the last decade an expression of climatic conditions. Rainfall in defect of normal is inimical to plague. The excessive rainfall of 1917 was responsible for the abnormally severe nature of the epidemic." Also given below are the extracts from Plague Enquiry in the Cumbum Valley, South India by P. V. George & Major W. J. Webster (I.J.M.R. 22, 1st July, 1934).

"Indigenous cases of human plague were not detected in the Madurai district until 1910, although for ten years before that many parts of the Presidency including the neighbouring district of Coimbatore had suffered severely from plague. It was ten years later before human plague infection was recognised in the Cumbum Valley."

"Permanently to abolish plague infection from the Cumbum family by human endeavour can scarcely be regarded as a practicable proposition. There will however be less human plague the more the people learn to discourage rats from sharing their habitations."

Vital Statistics of Plague

Just as in the case of cholera, the vital statistics of plague should serve as an early warning about an epidemic and serve as the basis for preventive measures. The records of plague are intended to show (*a*) Dates of outbreaks and subsidence, (*b*) Localities first affected, (*c*) Locality worst affected, (*d*) Source of infection, (*e*) Routes taken by infection in spreading, (*f*) Movement of grain trade into and within the local area. Every town and panchayat should have the genesis and history of the plague epidemics which have afflicted it, particularly about the localities and buildings where the outbreaks began and the sources from which the infection has been imported. These particulars should form the foundation of the preventive policy of the local bodies.

We may now look into the plague mortality in the recent years in comparison with what existed half a century earlier.

TABLE 8-5

Mortality from Plague, 1902-60

District		1902-26 annual average	1956-60 annual average
Madras	...	7	...
Chingleput	...	4	...
North Arcot	...	656	...
South Arcot	...	7	...
Salem	...	1,248	5
Coimbatore	...	1,934	...
Nilgiris	...	81	...
Madurai	...	754	...
Tiruchirapalli	...	28	...
Thanjavur	...	8	...
Ramanathapuram	..	37	...
Tirunelveli	...	11	...
Kanyakumari	...	...	...
State	...	4,775	5

In the earlier period, plague mortality for the State was around 5,000 per annum. Figures of the annual plague mortality for 1902–21 show that big epidemics recur at irregular intervals and some districts are never free from plague while others are relatively immune. The plague mortality was particularly heavy in Coimbatore, Salem, North Arcot and Madurai districts. Russel has reported the following facts : " Salem District is regularly infected from the Mysore State through Hosur, and once plague appears in that town, it is a matter of a few weeks or even days for it to make its appearance in Salem town itself. In Coimbatore Town, Uppilipalayam and the weavers' and chucklers' quarters are well known foci of infection from which plague spreads year by year."

In contrast with this picture we have today a mortality of about 5 per annum.

That plague is almost at the point of elimination will be evident from the following figures of attacks and deaths during the last ten years.

TABLE 8–6

Notified cases of Plague and deaths, 1951–60

Year		Notified cases	Deaths	Percentage
1951	...	16	3	18.8
1952	...	23	4	17.4
1953	...	9	6	66.7
1954	...	8	6	75.0
1955	...	...	...	...
1956	...	2	1	50.0
1957	...	4	1	25.0
1958	...	1	...	...
1959	...	17	7	41.2
1960	...	29	14	48.3
1951-60—Total	...	109	42	38.5
Average	...	11	4	38.5

There are hardly a dozen cases of plague reported per annum and the deaths due to plague are still less. The few cases that are reported every year in Salem district are unavoidable owing to the difficulty in preventing the infection from spreading from the adjoining areas of Mysore State. This is an area of action where a joint effort of both the Madras and Mysore Governments is required.

3. MALARIA

Nature of the disease

Malaria is a disease which is prevalent in a mild form in many parts of the State and a large number of deaths registered as 'fevers' are probably due either primarily or secondarily to infection with the malaria parasite. Malarial fever is caused by the presence of a minute animal parasite in the blood of man. When a certain kind of mosquito sucks up the blood of man suffering from malaria it also conveys to its stomach the malarial parasite. Within the body of the mosquito, the parasite undergoes certain changes which enable it to pass through the sucking tube of the mosquito to any human being from which blood is drawn by it. In this way, the cause of malarial fever can be transferred from human being to human being. All that is necessary therefore, to cause malarial fever to break out in a village is the presence of the blood parasite in human beings and the special mosquito in the body of which the change of the parasites can take place.

Vital Statistics of Malaria

Plague, small-pox and cholera were the only diseases universally notifiable in British India. The rest are notifiable in certain areas, and in all other areas they are reported only in a rudimentary manner that makes statistical treatment impossible. Malarial deaths are often registered under " fevers " along with deaths from many other causes. The exact proportion of 'fever' deaths due to malaria is unknown, but according to Gyanchand it can be as high as one-third, which would mean that roughly 20% of all the deaths in India are traceable to this disease alone. Kingsley Davis has estimated that in 1940 the annual death rate from this disease is about 5 per thousand persons or nearly three times the rate for plague, small-pox and cholera combined. In 1955–56 the malarial deaths constituted 0.37% of the total deaths registered in municipal areas and the percentage has fallen to 0.15 in 1956–60. A comparative picture of malarial mortality in Madras State can be had from Table 8–7.

TABLE 8–7

Mean mortality from Malaria

District	1921–30			1956–60	
	Fevers includ-ing malaria (per year)	Malaria [estima-ted as $\frac{1}{4}$ of Col. (2)]	Rate per lakh of popula-tion	Malaria	Rate per lakh of popula-tion
1	2	3	4	5	6
Madras ...	2,314	579	87.29	77	4.70
Chingleput ...	5,977	1,494	94.58	413	19.39
North Arcot ...	7,867	1,967	90.67	571	18.55
South Arcot ...	10,703	2,676	111.93	213	7.16
Salem ...	15,513	3,878	169.73	1,661	45.09
Coimbatore ...	8,357	2,089	93.89	536	15.56
Nilgiris ...	1,440	360	243.75	75	19.70
Madurai ...	6,351	1,588	75.80	290	9.29
Tiruchirapalli ...	8,361	2,090	109.51	495	15.85
Thanjavur ...	6,920	1,730	73.31	265	8.35
Ramanathapuram.	11,431	2,858	159.39	316	13.58
Tirunelveli ...	8,659	2,165	107.40	234	8.77
Kanyakumari ...	...	...	...	24	2.53
State ...	93,893	23,474	108.51	5,170	15.81

In the above table we have assumed that one-fourth of the deaths from fevers other than malaria should be actually due to malaria. This assumption is arbitrary but must be fairly close to reality since Kingsley Davis has shown that an assumption of one-third will be a bit high. It is obvious that malarial mortality has declined considerably in the last 40 years. Among the different districts the rate is comparatively higher in Salem, Nilgiris, Chingleput and North Arcot districts.

Table 8–8 shows the mortality from malaria in different areas of the State during 1956—1960 as published by the Director of Public Health, Madras.

Very little can be said by way of comparison between the different areas since the registration efficiency of the different areas is not uniform. It appears likely that the malarial deaths will be higher for rural areas than in the urban areas due to lack of medical facilities in rural areas.

TABLE 8–8

Mortality rates in different areas of the State, 1956–60

Area	1956		1957		1958		1959		1960	
	No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
State ...	1,603	0.05	969	0.03	1,229	0.04	732	0.02	637	0.02
Rural ...	1,251	0.05	693	0.03	1,054	0.04	574	0.02	505	0.02
Urban ...	352	0.04	276	0.03	175	0.02	158	0.02	132	0.01
Municipal Towns ...	250	0.05	181	0.03	106	0.02	95	0.02	67	0.01
Census Towns ...	102	0.04	95	0.05	69	0.02	63	0.02	65	0.02

4. SMALL-POX

Nature of the disease

Small-pox is a typical acute microbial disease which affects both men as well as animals. The contagion is very persistent, and has been proved to carry through the air for distances upto a mile. Houses within a radius of half a mile of a small-pox hospital have been found to be attacked at three times the rate of those beyond the mile radius. Infection may also be conveyed by the clothes of a small-pox patient, by vehicles in which small-pox patients have travelled and by the clothes of persons who have been in contact with small-pox cases.

Vital Statistics of Small-pox

Like the statistics of any other cause of death, the statistics of mortality due to small-pox suffer from under-registration. But fortunately, the other common error of wrong classification does not arise in the case of small-pox since the symptoms of small-pox are well recognised in India from the earliest times. In fact, as soon as a case of small-pox or '*Periya Ammai*' as it is commonly known in Madras occurs in any family,

the members of the family observe exceptional cleanliness, and in front of the house they keep a neem branch which serves as a warning to visitors to observe the cleanliness. The disease is attributed to the visitation of the Goddess Mariamma and the people are averse to hospitalising such cases. But whenever there is a case of small-pox in a village, the whole village knows about it and the village headman who is the registrar of births and deaths in the village must be surely aware of the occurrence. When this is the case, the statistics of mortality due to small-pox must be more accurate than any other cause and we must be able to place more reliance on these figures. Table 8-9 compares the small-pox mortality rates in 1956-60 with that of 1901-26.

TABLE 8-9

Mean death rates from Small-pox

District	1901-26		1956-60	
	Annual average	Rate per lakh of persons	Total deaths	Rate per lakh of persons
Madras ...	245	50	2,923	178.32
Chingleput ...	681	50	1,565	73.47
North Arcot ...	2,140	70	1,135	36.87
South Arcot ...	2,118	90	1,463	49.21
Salem ...	1,070	50	1,602	43.49
Coimbatore ...	1,239	60	1,261	36.60
Nilgiris ...	51	40	119	31.28
Madurai ...	1,772	50	710	22.74
Tiruchirapalli ...	1,026	40	820	26.26
Thanjavur ...	1,520	70	1,468	46.26
Ramanathapuram	included in Madurai	50	651	27.99
Tirunelveli ...	595	30	555	20.80
Kanyakumari ...	...	...	217	22.89
State ...	...	...	14,489	44.32

In the earlier period there was hardly a district which did not suffer at one time or other from small-pox in epidemic form and no area was ever free from this disease in spite of the fact that vaccination has been carried on throughout the period. The death rate from small-pox during 1901-1960 has varied approximately from 0.3 to 2.0 per thousand deaths having occurred in 20% of the reported cases. While it was endemic in nearly every province in India, it was found to have a periodicity of 2-5 years.

In Madras City, for instance during 1919, although the disease was stated to be only in a sporadic form, the number of attacks during that year was 1,227 of which 611 or 49.8% proved fatal. The annual death rate was 1.2 per mille as compared with a mean death rate of 0.5 per mille in 1914-18. During the later months of 1921 and the early months of 1922, Madras was again visited by a severe epidemic which spread over the whole city ; 1,487 cases were reported, and 509 persons died. Madurai Town during the same period passed through a similar experience in which the children under 5 years of age suffered severely. Further, the statistics of small-pox deaths for this period show that in almost every district the period of the highest incidence of the disease ended in March rising in January and February and declining in June and July which indicated the need for intensification of preventive measures in the first quarter of every year.

Apart from the formidable death roll, small-pox in India is the cause of much suffering and disfigurement and is in addition responsible for greater proportion of blindness and deafness met with. Hundreds of patients attend the Government Ophthalmic Hospital annually suffering from total blindness as a result of an attack of small-pox. The Physically Handicapped Survey of 1963 has revealed that 10% of the blind persons found in the survey have suffered this handicap due to small-pox.

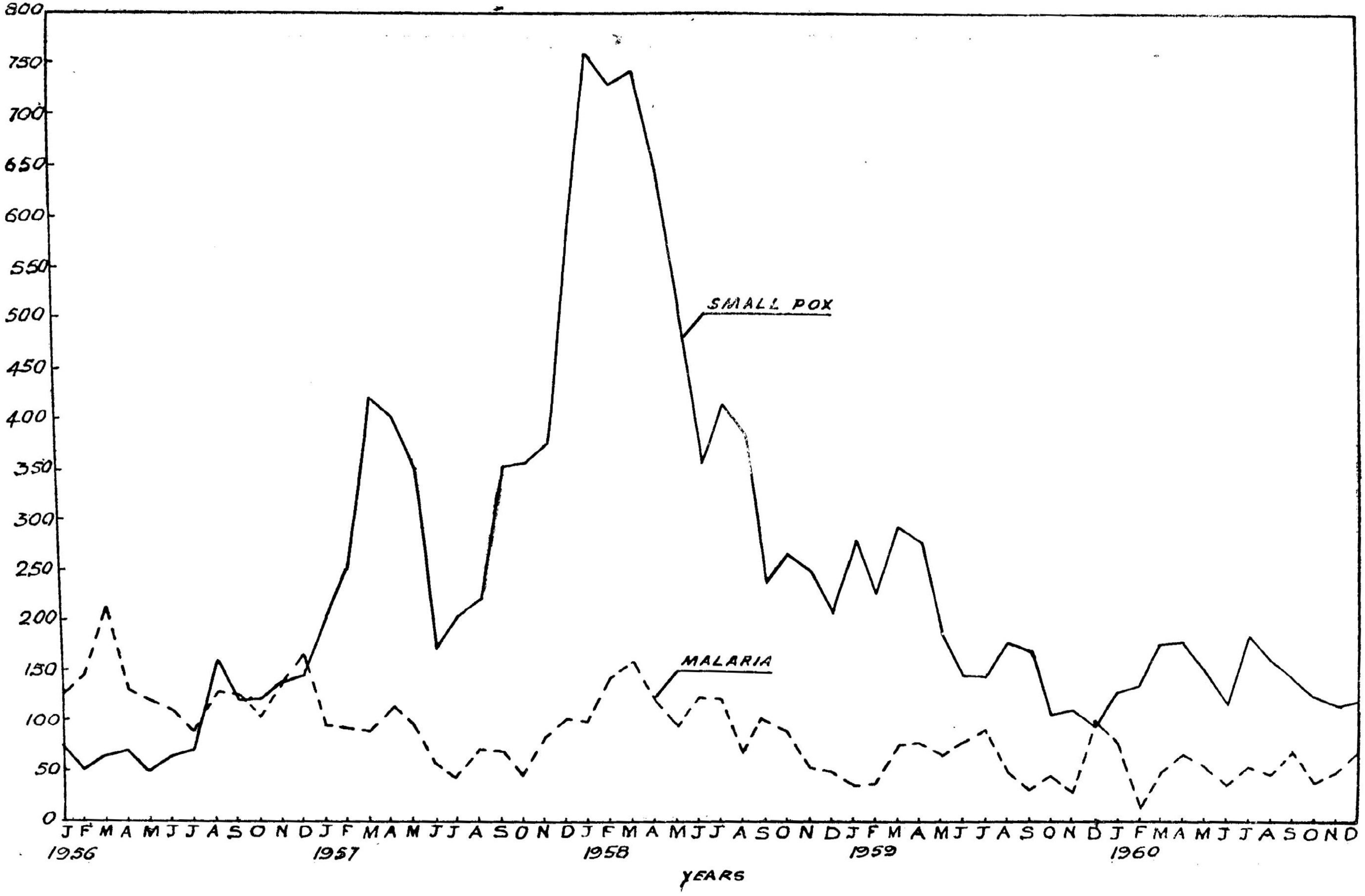
In contrast to this picture we have fewer cases of attacks of small-pox today and still fewer cases of deaths. Table 8-10 gives the number of attacks and deaths reported during the last 10 years.

TABLE 8-10

Notified cases of small-pox and deaths, 1951-60

Year	Notified cases	Deaths	Percentage
1951 ...	32,476	7,930	24.4
1952 ...	7,045	2,385	33.9
1953 ...	2,737	2,588	94.6
1954 ...	7,536	1,409	18.7
1955 ...	1,242	1,101	88.6
1956 ...	3,754	1,129	30.1
1957 ...	12,512	3,893	31.1
1958 ...	13,852	5,498	39.7
1959 ...	6,599	2,225	33.7
1960 ...	5,417	1,744	32.2
1951-60—Total...	93,170	29,902	32.1
Average...	9,317	2,990	32.1

MONTHWISE STATISTICS OF DEATHS FROM MALARIA & SMALL POX, 1956 TO 1960



We have less than 10,000 notified cases of small-pox per annum during the last decade and nearly 3,000 persons died. The fatality rate of nearly one-third is quite high judging from the fact that scientific advancement has provided a solution to the problem of small-pox. The distribution of small-pox deaths in different areas of the State in 1956–60 are given in Table 8–11.

TABLE 8–11

Small-pox deaths and death rates for different areas, 1956–60

Area		1956		1957		1958		1959		1960	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
State	...	1,129	0.03	3,893	0.12	5,498	0.17	2,225	0.07	1,744	0.05
Rural	...	780	0.03	1,996	0.08	3,212	0.13	1,337	0.05	894	0.04
Urban	...	349	0.04	1,897	0.23	2,286	0.27	888	0.10	850	0.09
Municipal Towns	...	261	0.05	1,447	0.26	1,949	0.34	821	0.14	754	0.12
Census Towns	...	88	0.03	450	0.16	337	0.12	67	0.02	96	0.03

It appears from this table that the mortality rate due to small-pox is higher in municipal areas than in the rural areas and Census towns, whereas one should expect a contrary picture. This is due to the serious under-registration of deaths due to small-pox in rural areas and more so in Census towns. The distribution of small-pox deaths by age groups are given in Table 8–12 for the years 1959 and 1960.

TABLE 8–12

Distribution of small-pox deaths by age groups, 1959–60

Age Group	1959		1960	
	No.	Percentage	No.	Percentage
Under one year ...	535	24.0	466	26.7
One year & less than 10 years ...	841	37.8	736	42.2
10 years and above..	849	38.2	542	31.1
Total ...	2,225	100.0	1,744	100.0

In 1956–60, we have an annual average of 14,400 deaths due to small-pox, with a rate of 44 per lakh of population. This is low when compared to the rates that existed half a century ago, but is nevertheless high when compared to the rates of developed countries. The reduction in small-pox mortality has been mainly due to the increase in the number of vaccinations during this period. But still more remains to be done and in a country like India, it is easier to eliminate small-pox than most other diseases. The act of vaccination is quite simple ; it costs less per person and can be accomplished on a mass scale with a small staff and a single vaccination is effective for nearly ten years, and is partially effective throughout life. What is most surprising is that in five out of the twelve districts we find that the number of annual average of deaths due to small-pox is higher in 1956–60 when compared to 1901–26. One reason for this is the fact that the main progress in controlling this disease was made prior to 1900, and small-pox control has not been a significant factor in the reduction of the Madras death rate since 1900. The Sanitary Commissioner for the Government of India wrote in the 1870 report : " The mortality which is due to small-pox is year by year so heavy that the

prevention of no one disease is of so great importance to the people of India." These remarks hold good even today.

5. RELAPSING FEVER

Nature of the disease

Till 1922, Madras State was regarded as immune from relapsing fever, but in March, 1922 reports were received of a new and deadly epidemic in Thanjavur District. Relapsing fever was widely prevalent in the Mysore State for a long time and an outbreak occurred in the adjoining taluk of Hosur in Salem district in October, 1921, but fortunately it had only a limited effect. The Thanjavur outbreak, the origin of which has not been traced so far, stood on a different footing. The investigations conducted by the Public Health Department revealed that this disease had established itself in the taluks of Papanasam, Kumbakonam and Thanjavur in Thanjavur district and of Lalgudi and Udayarpalayam in Tiruchirapalli district for seven months, before it was detected by the authorities locally responsible for the public health administration. The disease was confined almost exclusively to the Paraiyar and Pallar communities, and it is significant that neither the local village officers nor the landlords, in whose service the Paraiyars and Pallars are employed, soon interested themselves in combating it. The unfortunate victims, however, realised the character of the epidemic sufficiently clearly to describe it as "Parakkachal" (Paraiyar's fever) which they attributed to the pollution of a sacred tank in Kumbakonam by a Paraiyan. They also realised that the virulence of this house-borne disease could be abated by the simple expedient of shaving the head.

Vital Statistics of Relapsing Fever

Separate statistics of deaths due to Relapsing fever are not available for all areas, but in the municipal areas, the optional provision has enabled the compilation of such statistics. During the period 1956–60, only 5 cases of deaths due to Relapsing fever has been reported in the State, constituting 0.001%. The three areas affected by Relapsing fever are Hosur taluk of Salem district, and parts of Thanjavur and Tiruchirapalli districts. It was prevalent in an epidemic form in Thanjavur and Tiruchirapalli districts and the figures in Table 8–13 will show the extent of mortality in these two districts.

The figures can be taken as only approximate, but they are useful in giving an idea of the incidence of the disease. The deaths amount to 37.3% of the attacks

TABLE 8–13

Extent of mortality due to Relapsing fever in Tiruchirapalli and Thanjavur districts

Area		Attacks	Deaths	Percentage
Tiruchirapalli District :				
Lalgudi taluk	...	2,030	619	30.5
Udayarpalayam Taluk	...	3,101	913	29.4
Thanjavur District :				
Papanasam taluk	...	643	418	65.0
Kumbakonam taluk	...	1,671	767	45.9
Thanjavur taluk	...	1,615	665	41.2
Total	...	9,060	3,382	37.3

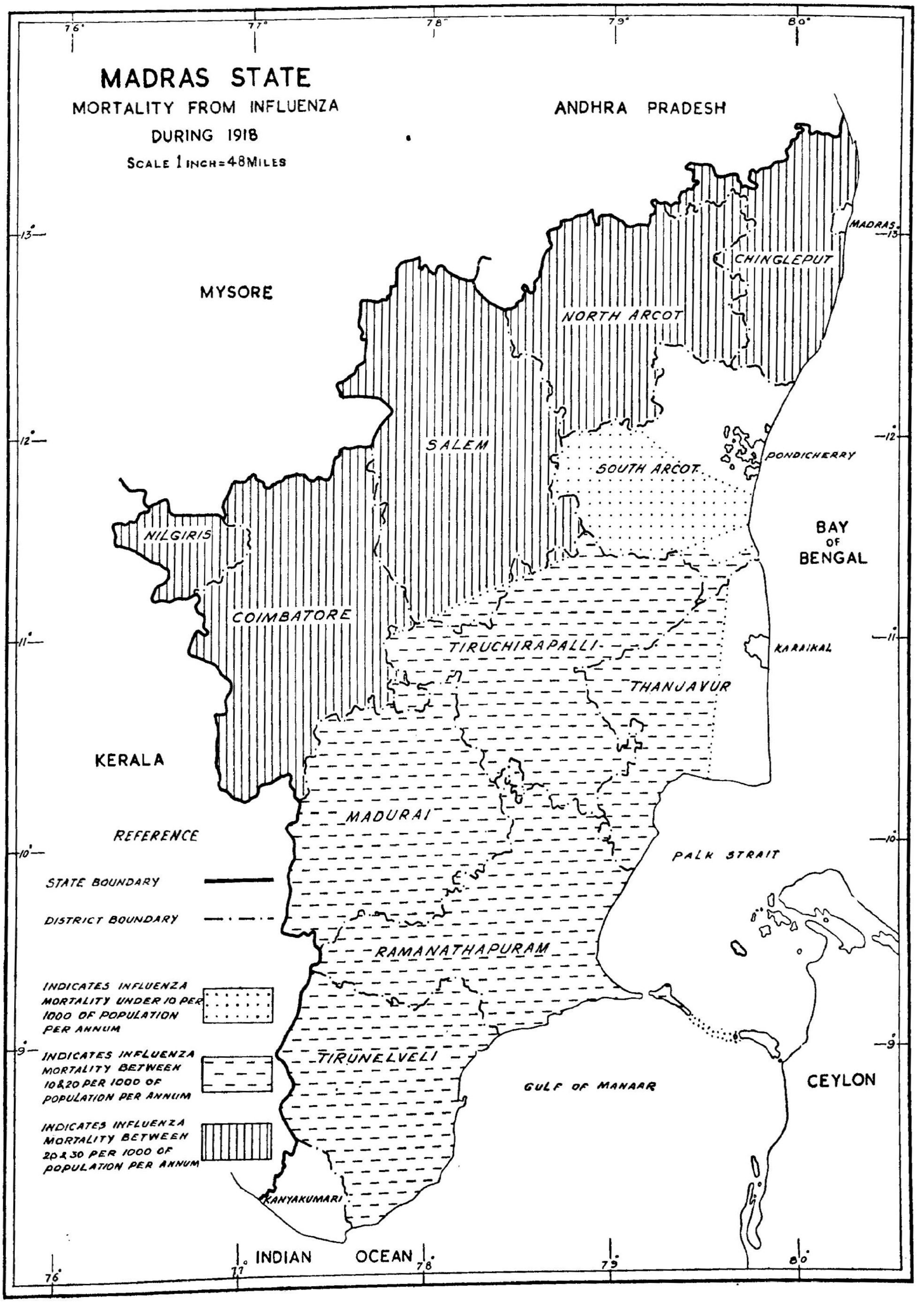
but in some villages as high a proportion as 66% of the persons attacked had perished. In several of the infected villages, 70–80% of the population suffered from this disease. The statistics also show the seasonal nature of the disease, the mortality being very heavy in January to March. It was also found that the age group 20–40 and above were the worst affected and females were more affected than males. Russel has found that 126 females died for every 100 males. We may now compare the average annual mortality from Relapsing fever in 1934–41 with that of 1956–60. (Table 8–14).

It will appear from Table 8–14 that the number of cases of Relapsing fever reported has not fallen over the period 1934–41 to 1956–60. However, the deaths due to this cause are few and are limited to the districts of South Arcot, Ramanathapuram and Kanyakumari.

6. INFLUENZA

Nature of the disease

Influenza is a dangerous disease which occurs either in a mild or a severe form. The mild form is very much like a severe attack of cold that it is likely to be



MADRAS STATE
MORTALITY FROM INFLUENZA
DURING 1918
SCALE 1 INCH=48 MILES
ANDHRA PRADESH
MYSORE
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
PONDICHERRY
SOUTH ARCOT
BAY OF BENGAL
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
KERALA
MADURAI
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
PALK STRAIT
RAMANATHAPURAM
INDICATES INFLUENZA MORTALITY UNDER 10 PER 1000 OF POPULATION PER ANNUM
INDICATES INFLUENZA MORTALITY BETWEEN 10&20 PER 1000 OF POPULATION PER ANNUM
INDICATES INFLUENZA MORTALITY BETWEEN 20&30 PER 1000 OF POPULATION PER ANNUM
TIRUNELVELI
GULF OF MANAAR
CEYLON
KANYAKUMARI
INDIAN OCEAN
76°
77°
78°
79°
80°
13
12
11
10
9

TABLE 8-14

Average annual mortality from Relapsing Fever in Municipal Areas

District	1934–41	1956–60
Madras ...	...	...
Chingleput ...	...	...
North Arcot ...	...	...
South Arcot ...	...	0.2
Salem ...	...	...
Coimbatore ...	...	...
Nilgiris ...	...	...
Madurai ...	...	...
Tiruchirapalli ...	...	...
Thanjavur ...	...	...
Ramanathapuram ..	0.5	0.2
Tirunelveli ...	...	...
Kanyakumari ...	...	0.6
State ...	0.5	1.0

neglected. It may then change into a severe attack when neglected in the beginning. The symptoms of this disease are weakness, severe headache, shivering and fever, running nose and sore throat. The severe form is characterised by the above symptoms and added local complications pointing to the involvement of the lung, heart, the digestive system, nerves, etc. The lungs are most often affected, the common complications being either severe bronchitis or pneumonia. The cause of influenza is a very small germ found in the sputum and secretions of the nose, mouth and throat of infected persons. The infection finds its way into the air by coughing, spitting and sneezing of persons suffering from the disease. The small infected droplets thus discharged into the air float about for a long time and infect healthy persons in the neighbourhood.

Vital Statistics of Influenza

Statistics of influenza mortality are not available separately in the vital statistics returns of the State and is normally included in fevers other than malaria. However, under the optional clause, statistics are compiled for municipal areas and these figures may be used for a comparison. In 1918, there was a great influenza epidemic in the whole of India in which more than 16 million people died. It has been estimated that the death toll in the present Madras State has been of the order of one million. Leaving aside this abnormal period, we may take the 1921–30 decade and compare the average mortality during this decade with that of 1956–60. Since the figures are available only for municipal areas it will suffice to compare these figures. Since the number of deaths from influenza in the quinquennium 1956–60 is small, it is enough to compare the absolute numbers instead of the rates.

TABLE 8-15

Average annual deaths from Influenza in municipal areas

District	Average annual deaths	
	1934–41	1956–60
Madras ...	...	5.4
Chingleput ...	5.0	1.4
North Arcot ...	13.0	5.6
South Arcot ...	11.3	2.2
Salem ...	1.6	0.4
Coimbatore ...	11.5	3.4
Nilgiris ...	4.8	1.4
Madurai ...	46.8	4.0
Tiruchirapalli ...	4.9	1.8
Thanjavur ...	17.8	3.2
Ramanathapuram...	13.9	2.0
Tirunelveli ...	14.3	1.0
Kanyakumari ...	...	0.4
State ...	144.9	32.2

TABLE 8-16

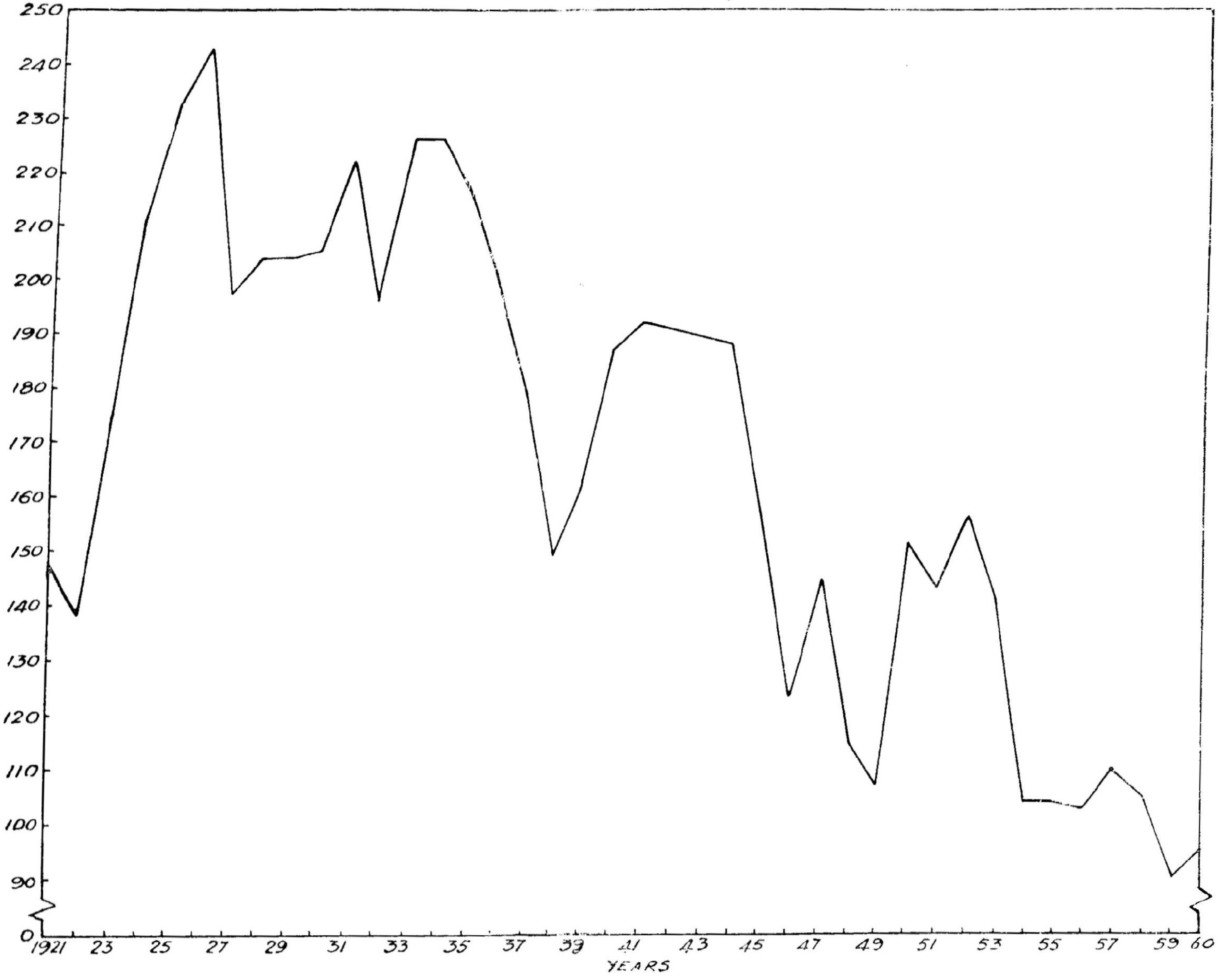
Death rate from Fevers including Malaria, Dysentery and Diarrhoea, Respiratory diseases for Madras State

Year		Estimated mid-year population	Deaths due to			Death rates per 100,000 from		
			Fevers including Malaria	Dysentery and Diarrhoea	Respiratory diseases	Fevers including Malaria	Dysentery and Diarrhoea	Respiratory diseases
1921	...	20,764,021	92,764	30,715	21,672	447	148	104
1922	...	20,932,962	98,681	28,808	22,818	471	138	109
1923	...	21,105,768	93,790	36,865	25,372	444	175	120
1924	...	21,279,510	89,524	45,036	30,749	421	212	145
1925	...	21,455,212	87,446	50,014	36,797	408	233	172
1926	...	21,632,885	88,364	52,473	40,099	408	243	185
1927	...	21,812,590	88,433	42,874	39,216	405	197	180
1928	...	21,994,474	95,917	44,853	42,660	436	204	194
1929	...	22,178,503	99,717	45,231	43,628	450	204	197
1930	...	22,364,460	104,278	45,912	44,734	466	205	200
1931	...	22,573,346	108,723	50,155	47,705	482	222	211
1932	...	22,825,741	96,286	44,810	45,218	422	196	198
1933	...	23,081,281	98,751	52,209	49,559	428	226	215
1934	...	23,340,032	105,222	52,862	51,475	451	226	221
1935	...	23,602,047	105,949	51,095	54,224	449	216	230
1936	...	23,867,410	97,615	48,080	54,460	409	201	228
1937	...	24,136,182	100,098	43,271	55,610	415	179	230
1938	...	24,408,480	96,098	36,273	54,947	394	149	225
1939	...	24,684,324	99,296	40,015	58,117	402	162	235
1940	...	24,963,943	105,809	46,757	58,720	424	187	235
1941	...	25,263,816	111,462	48,620	60,918	441	192	241
1942	...	25,600,794	...	...	...	...	...	...
1943	...	25,944,063	...	...	...	...	...	...
1944	...	26,293,877	134,051	49,404	65,805	510	188	250
1945	...	26,650,488	122,245	41,729	59,013	459	157	221
1946	...	27,014,237	96,716	33,321	55,060	358	123	204
1947	...	27,385,494	95,463	39,684	56,683	349	145	207
1948	...	27,764,597	86,061	31,842	53,200	310	115	192
1949	...	28,621,933	81,242	30,576	50,884	284	107	178
1950	...	29,021,917	99,599	44,062	58,904	343	152	203

The figures relate to State exclusive of Kanyakumari district.

DEATH RATES FROM FEVERS INCLUDING MALARIA FOR MADRAS STATE, 1921-60
(PER LAKH)

DEATH RATES FROM DYSENTERY AND DIARRHOEA FOR MADRAS STATE, 1921-60
(PER LAKH)



DEATH RATES FROM RESPIRATORY DISEASES FOR MADRAS STATE, 1921 - 60
(PER LAKH)

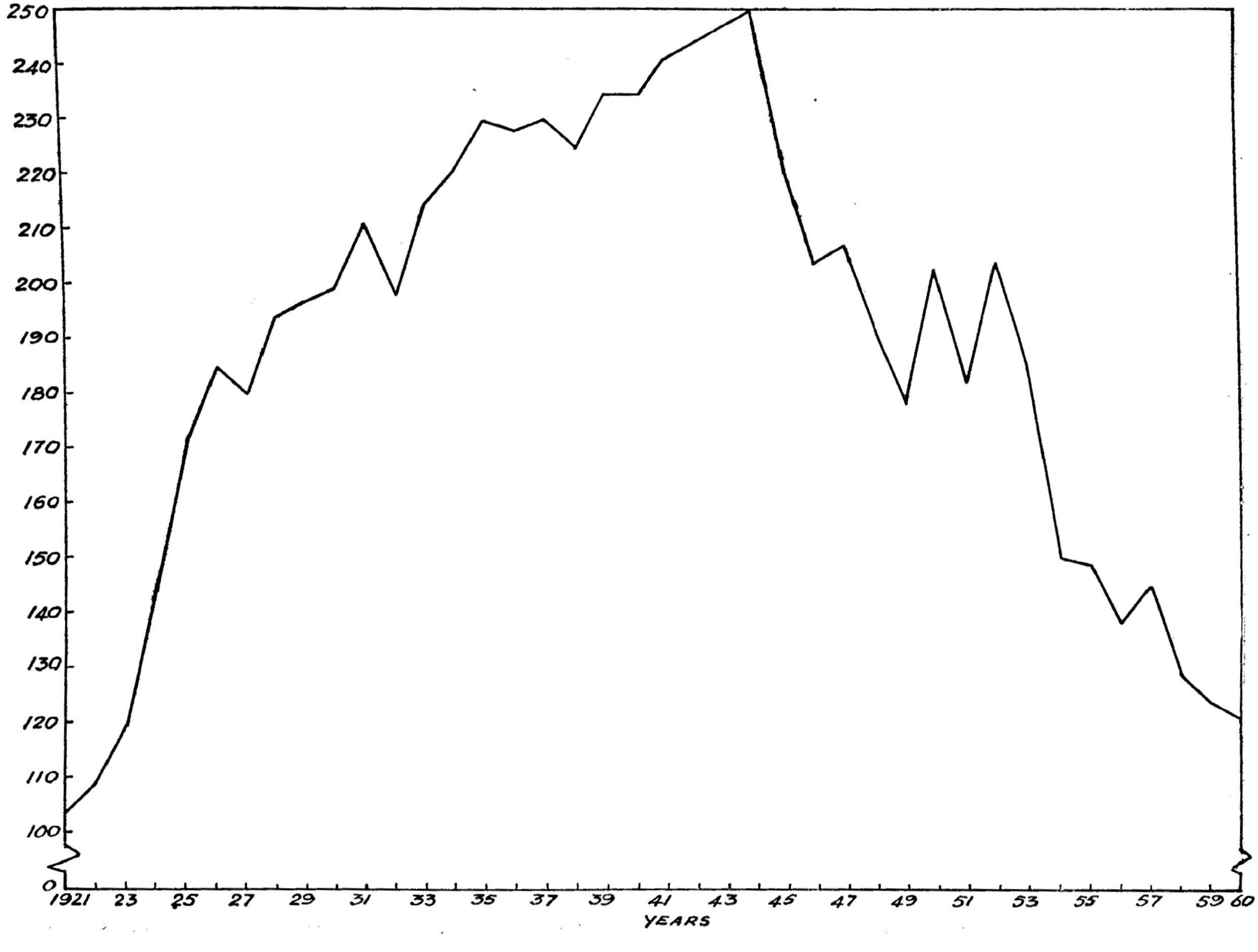


TABLE 8-17

Death rate from Fevers exclusive of Malaria, Malaria exclusive of Fevers, Dysentery and Diarrhoea, Respiratory diseases for Madras State

Year		Estimated mid-year population	Deaths due to: Malaria exclusive of fevers	Deaths due to: Fevers exclusive of Malaria	Deaths due to: Dysentery and Diarrhoea	Deaths due to: Respiratory diseases	Death rates per 100,000 from: Malaria exclusive of fevers	Death rates per 100,000 from: Fevers exclusive of Malaria	Death rates per 100,000 from: Dysentery and Diarrhoea	Death rates per 100,000 from: Respiratory diseases
1951	...	29,399,741	1,287	84,526	42,138	53,560	4	288	143	182
1952	...	29,722,255	2,224	75,919	46,368	60,609	7	255	156	204
1953	...	30,048,700	1,556	87,973	42,305	55,726	5	293	141	185
1954	...	30,379,189	1,524	72,711	31,658	45,691	5	239	104	150
1955	...	30,713,701	1,381	75,095	32,015	45,671	4	245	104	149
1956	...	31,965,591	1,603	66,244	33,006	44,221	5	207	103	138
1957	...	32,325,837	969	72,267	35,401	46,978	3	224	110	145
1958	...	32,690,825	1,229	64,491	34,406	42,258	4	197	105	129
1959	...	33,060,567	732	57,572	29,033	40,856	2	174	88	124
1960	...	33,435,162	637	59,982	31,739	40,612	2	179	95	121

Upto 1955, the figures relate to State exclusive of Kanyakumari District.

7. DYSENTERY AND DIARRHOEA

Nature of the disease

Dysentery and diarrhoea are caused by exposing the belly to cold, by errors in diet, especially by the use of decomposed food, milk or vegetables, by using foul drinking water, or by allowing faeces matter of human beings and animals and other foul matter to lie in the vicinity of the house, so that dust containing filth and flies with filth on their feet reach food, milk and water.

Vital Statistics of Dysentery and Diarrhoea

In spite of the fact that provision for dysentery and diarrhoea exists in the returns ever since the beginning of registration in the State, the registrars of births and deaths commit mistakes in identifying this cause. On the one hand, there is omission of many deaths due to dysentery and diarrhoea; and there is also a tendency to report deaths due to cholera as those due to dysentery and diarrhoea. Since the number of deaths due to cholera are fewer, and not all of them are wrongly transferred to dysentery and diarrhoea, the deaths due to this cause remains undercounted. A comparative picture of the mortality due to dysentery and diarrhoea in the last half a century can be had from Table 8-18.

TABLE 8-18

Mortality due to Diarrhoea and Dysentery

District		1921-30: Annual average	1921-30: Rate per lakh of population	1956-60: Annual average	1956-60: Rate per lakh of population
Madras	...	3,653	550.75	5,059	308.63
Chingleput	...	3,528	223.33	2,322	109.01
North Arcot	...	4,361	201.02	5,482	178.08
South Arcot	...	4,243	177.47	2,914	98.01
Salem	...	3,092	135.33	2,088	56.69
Coimbatore	...	6,567	295.15	2,925	84.91
Nilgiris	...	636	430.62	228	59.93
Madurai	...	4,080	194.75	2,514	80.51
Tiruchirapalli	...	2,918	152.90	2,243	71.83
Thanjavur	...	2,897	122.77	1,621	51.08
Ramanathapuram.		2,800	156.16	1,970	84.70
Tirunelveli	...	3,503	173.77	2,364	88.59
Kanyakumari	...	...	...	987	104.10
State	...	42,278	195.43	32,717	100.08

The rate of mortality due to diarrhoea and dysentery has been reduced to half its size over the forty year period, 1921-60. While these figures give a comparative

picture over 40 years, it will be relevant to compare the figures for the last decade.

TABLE 8-19

Deaths due to Diarrhoea and Dysentery, 1951-60

Year		No.	Rate per thousand
1951	...	42,138	1.43
1952	...	46,368	1.56
1953	...	42,305	1.41
1954	...	31,658	1.04
1955	...	32,015	1.04
1956	...	33,006	1.03
1957	...	35,401	1.10
1958	...	34,406	1.05
1959	...	29,033	0.88
1960	...	31,739	0.95

Note: Figures for 1951-55 relate to State excluding Kanyakumari District.

While this table shows fluctuation in the death rates from dysentery and diarrhoea, Table 8-18 indicates that the mortality due to this cause is high in Madras, North Arcot, Chingleput and Kanyakumari districts and least in Thanjavur, Salem and Nilgiris. The rates in the different areas during the period 1956-60 are given in Table 8-19-A.

The data especially for rural areas and Census towns suffer from serious omission and mis-reporting and therefore we cannot attach much significance to a comparison of these figures except for an academic interest. But there can be little doubt that mortality due to this cause is very heavy even in recent years, and the decline in mortality due to this cause is less rapid than that of total mortality. Less attention seems to have been given to this class of disorders in India than to others and attention has to be bestowed on the establishment of hygienic conditions like purified drinking water, better food and promotion of clean habits if a reduction in mortality due to this cause has to be achieved. The use of D.D.T. and the use of sulpha drugs have brought about some improvement, but there is considerable leeway to make.

TABLE 8-19-A

Mortality from Dysentery and Diarrhoea for different areas, 1956-60

Area		1956		1957		1958		1959		1960	
		No.	Rate	No.	Rate	No.	Rate	No.	Rate	No.	Rate
State	...	33,006	1.02	35,401	1.09	34,406	1.05	29,033	0.87	31,739	0.94
Rural	...	20,120	0.85	21,387	0.89	21,353	0.88	16,943	0.69	19,439	0.79
Urban	...	12,886	1.55	14,014	1.66	13,053	1.52	12,090	1.37	12,300	1.37
Municipal Towns	...	11,102	2.01	11,859	2.12	11,002	1.92	10,292	1.71	10,308	1.65
Census Towns	...	1,784	0.64	2,155	0.76	2,051	0.71	1,798	0.64	1,992	0.72

TABLE 8-20

Relative decline in the deaths due to Cholera, Small-pox, Plague and Fevers

Year		Deaths due to Cholera	Deaths due to Small-pox	Deaths due to Plague	Total Columns 2 to 4	Fevers including Malaria exclusive of Kanya-kumari *	Total deaths	Total deaths exclusive of Kanya-kumari*	Percentage of Column 5 to Column 7	Percentage of Column 6 to Column 8
1		2	3	4	5	6	7	8	9	10
1921—30	...	211,389	74,504	41,355	327,248	938,914	4,799,466	4,733,283	6.82	19.84
1931—40	...	125,286	41,292	7,643	174,221	1,013,847	5,317,972	5,238,623	3.28	19.35
1941—50	...	180,315	43,892	14,895	239,102	1,072,352	5,695,874	5,606,068	4.20	19.13
1951—60	...	45,630	29,480	42	75,152	729,922	4,544,648	4,511,372	1.65	16.18

* Figures relate to the State excluding Kanyakumari District up to 1956. For 1956-60, figures include Kanyakumari District.

CHAPTER IX

MATERNITY AND CHILD WELFARE

One of the branches of Public Health Administration which has received considerable attention in recent years is that relating to maternity and child welfare. The main consideration which weighed with the Indian Government while accepting family planning as an official policy is to secure better health for mother and greater protection and better living levels for children. Added to this is the greater responsibility vested with local authorities for the implementation of the programme, which is in fact closely linked with the programmes for maternity and child welfare. The problems of maternity and child welfare are manifold and call for a thorough review of the schemes to tackle them in order to judge the extent of their adequacy and to organize measures for their further development.

The Reports on Health Conditions in Madras State published annually by the Director of Public Health, Madras contain information on the incidence of mortality in the different age groups and these present certain important characteristics. The first point is that the infant mortality both in Census towns and rural areas is lamentably high and secondly the death rates among females in the age groups 15 to 29 are considerably greater than the corresponding rates for males. Table 9-1 showing the mean death rates for the 5 year period 1956-60 in the State, illustrates these points.

TABLE 9-1

Mean death rates per 1,000 living at each age group

Age group	1951-55		1956-60	
	Males	Females	Males	Females
Under one year* ...	119.0	110.0	106.3	98.8
1—4 ...	25.5	25.2	22.1	23.2
5—9 ...	5.2	5.2	3.9	3.9
10—14 ...	3.6	4.0	2.3	2.6
15—19 ...	6.0	7.0	3.7	4.7
20—29 ...	4.9	5.9	3.5	4.8
30—39 ...	7.5	8.2	5.0	6.2
40—49 ...	12.6	10.8	8.5	7.8
50—59 ...	19.4	16.3	14.2	12.3
60+ ...	71.3	69.0	60.4	59.7
All ages ...	16.3	15.6	13.1	13.0

Infant Mortality Rate

The infant mortality rate (number of infant deaths per 1,000 live births) is a very sensitive index of the health conditions in any country. However, as pointed out in an earlier chapter, it is subject to considerable error which is difficult to measure. As a ratio of two factors *viz.*, infant deaths and live births, the infant mortality rate is affected by the errors in each of these factors. While the extent of inaccuracy of the rate for the State cannot be adequately measured, it is nevertheless evident that the rates cannot be assumed to indicate with any degree of accuracy, the actual facts. Investigation into the registration of vital statistics has incontestably proved that the registration efficiency is quite different in the municipalities, census towns and rural areas, and a better picture of the facts may be had by an examination of actual figures registered in certain towns. For instance, in 1960, Madras City registered an infant mortality rate of 122 while Madurai recorded a rate of 92, Coimbatore 85, Tiruchirapalli 57 and Vellore 117. Tiruvottiyur Municipality has recorded the rate of 226, the highest recorded in 1960. The lowest rate of 17 is recorded by Kuzhithurai Municipality in Kanyakumari District. For the period 1951-60, Madras City has registered an average infant mortality rate of 146 per thousand live births, the average number of deaths among children under one year of age amounting to as many as 9,526 per annum. The following statement gives the mean infant death rate registered in the different districts for the decennial period 1921-30, 1931-40, 1941-50 & 1951-60.

TABLE 9-2

Mean infant death rates for 1921—30 to 1951—60

District	Mean infant death rate for			
	1921-30	1931-40	1941-50	1951-60
Madras ...	270.5	232.1	195.6	145.8
Chingleput ...	192.6	184.5	169.2	125.5
North Arcot ...	156.7	155.4	148.7	113.9
South Arcot ...	179.3	165.8	161.5	109.0
Salem ...	170.7	166.8	136.3	95.4
Coimbatore ...	169.8	179.2	140.8	95.8
Nilgiris ...	195.6	162.6	142.9	92.5
Madurai ...	168.2	170.7	146.0	103.7
Tiruchirapalli ...	193.7	172.8	152.7	103.8
Thanjavur ...	187.3	176.6	161.9	102.6
Ramanathapuram	167.4	144.2	131.1	91.1
Tirunelveli ...	185.8	188.4	163.9	117.8
Kanyakumari ...	103.7	108.7	80.0	60.6
State ...	178.9	171.2	151.0	107.3

* Per thousand live births.

These figures are of course defective, and there can be no doubt that more than 9 lakhs of children born in the State during 1951-60 have died during their first year of life. When compared with western countries and even our neighbour Ceylon, these figures are highly disconcerting. In 1959 the infant death rate in Great Britain was only 23.3 per thousand live births, while in Australia and New Zealand the rates lie between 20 and 25 per thousand live births. In Ceylon, the corresponding figure is 57 in 1960. It is clear that there is considerable need for improvement, if we have to reach anywhere near the standard of western countries.

Let us now look at the rates for different areas and see if there are any differentials in Infant Mortality Rate between them.

TABLE 9-3

Infant Mortality Rate for different areas, 1956—60

Area	1956	1957	1958	1959	1960
State ...	116.7	110.7	103.4	91.1	91.6
Rural ...	121.4	113.7	105.4	91.7	95.1
Urban ...	106.7	104.5	99.5	89.9	85.2
Municipal Towns ...	110.6	108.1	104.5	95.1	88.8
Census Towns ...	93.7	91.9	81.8	72.5	72.4

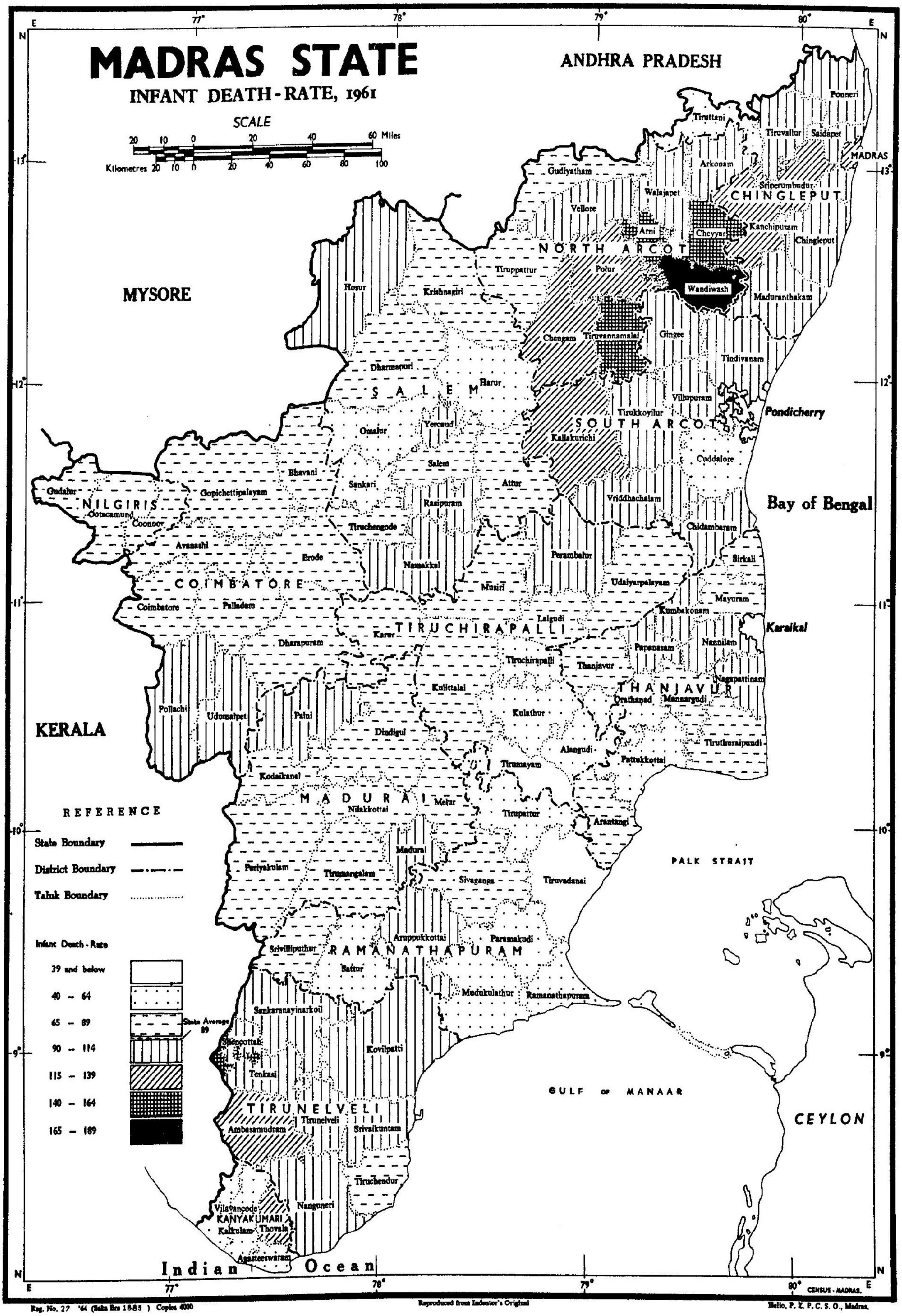
The rates in respect of urban areas are found to be lower than the rates for rural areas. The reason for this will be evident when we compare the figures for census towns with those of municipal towns. The rates for municipal towns are more or less similar to those of rural areas whereas those of census towns are considerably lower. It is common knowledge that census towns do not possess any special advantages such as hospital facilities, better sanitation, etc., which could explain a lower infant mortality rate when compared to municipal towns. Further, census towns are known to have certain disadvantages in the matter of registration machinery and procedure. They do not have any health officers and further, the registration system is, as in the case of rural areas, in the hands of a Karnam, and with his large jurisdiction he is unable to bestow adequate attention to this task. We can therefore conclude that the lower rate for census towns is due to the defective registration system rather than the prevalence of better sanitary and health conditions. The same conclusions will apply to the rural areas as well since the rural-urban rates do not show any difference (if we eliminate the census towns) whereas from the above argument we should expect a higher rate for rural areas. The following figures seem to point that omissions of infant deaths occur on a large scale particularly among those under one week.

TABLE 9-4

Infant Death Rates by age groups

Age Group	1956		1957		1958		1959		1960	
	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
Under 1 week ...	16.9	29.8	16.6	26.7	10.3	24.7	12.0	25.4	9.1	23.7
1 week—1 month ...	38.4	19.3	34.1	17.8	37.2	17.3	32.2	14.7	34.8	15.0
1 month—6 months ...	24.7	30.5	24.1	29.6	25.0	28.1	19.1	24.6	21.1	22.5
6 months—12 months ...	41.4	27.2	38.9	30.4	32.9	29.4	28.4	25.2	30.2	23.9
Total under one year ...	121.4	106.7	113.7	104.5	105.4	99.5	91.7	89.9	95.1	85.2

The neo-natal mortality rate in 1960 is 42.1 and the rate for the post-neo-natal group is 49.6. This is in sharp contrast with those of western countries where the former is higher. In U.K., the latter is only 25% of the total infant mortality rate. The post-neo-natal mortality is caused by environmental conditions and food, and this is yet another example of the gap between us and countries like U.K. in the matter of health. Another striking feature of this table is the low rates for rural areas when compared to urban areas in the age groups under one week. This may be due to (1) wrong reporting of age, (2) large omissions in these age groups in rural areas. It is common knowledge that age reporting is bad in India and census after census has stressed this. But the argument that people cannot make a distinction between a child of one week and one



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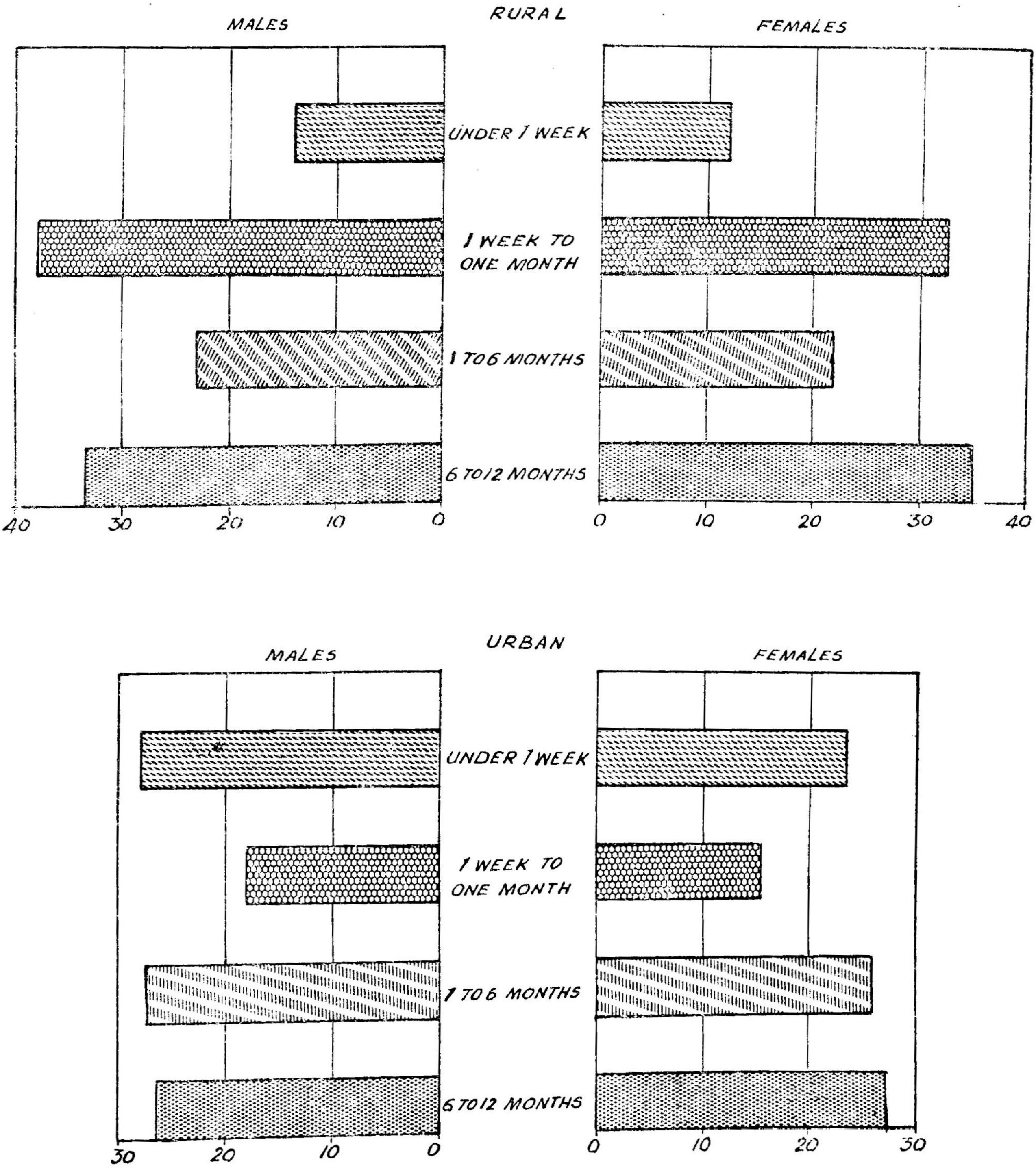
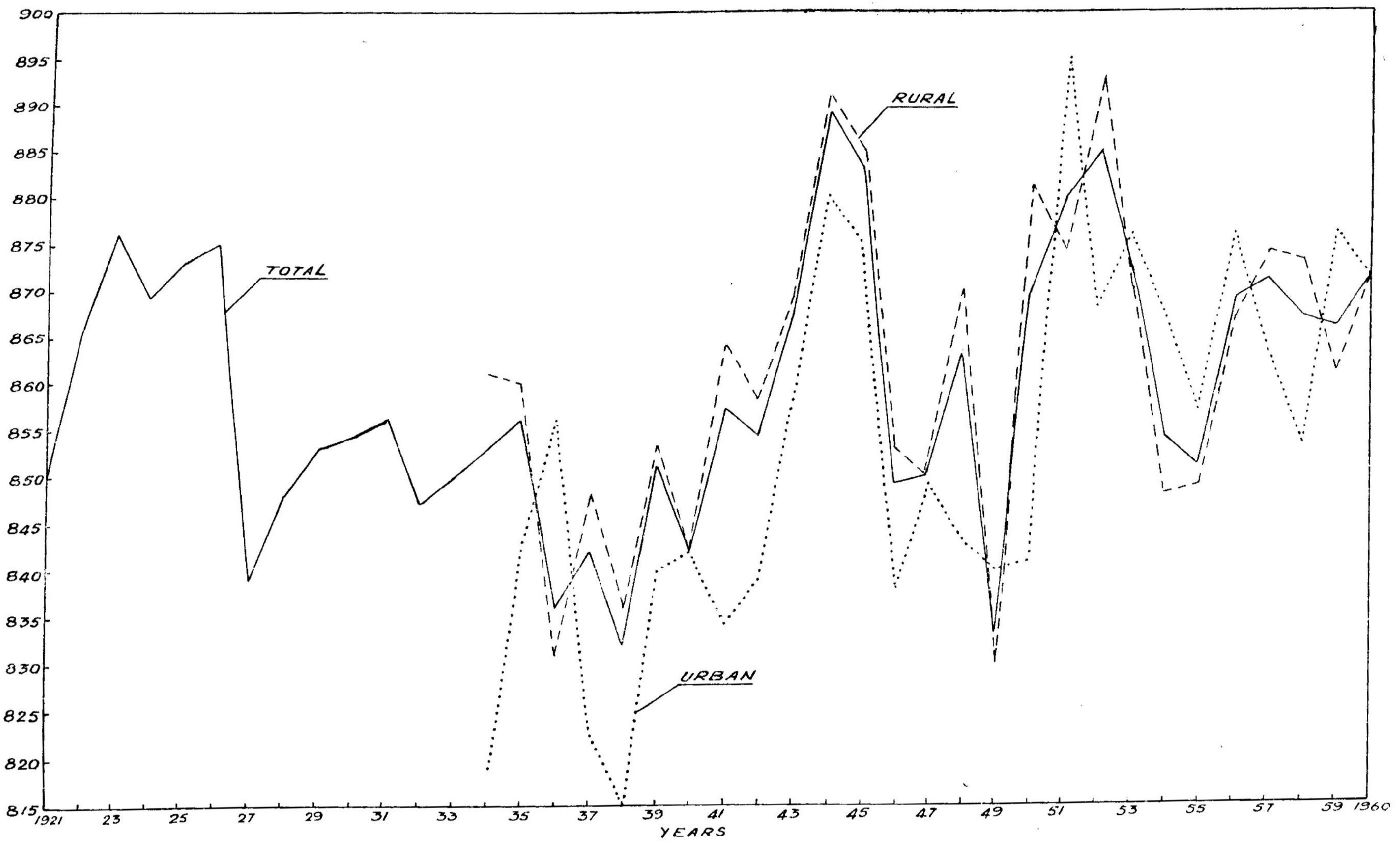
INFANT DEATH RATE BY AGE GROUPS

1956-60



SEX RATIO AMONG INFANT DEATHS (FEMALES PER 1,000 MALES)



month does not have force, since it is not like recalling whether one's age is 26 or 28. In the former, the memory is fresh and every period of a child's early existence is closely linked with festivities and rituals like Namakaranam, Annaprasanam, etc., that one can hardly be expected to have any difficulty in recalling the age of the child. Even if this is granted, it appears doubtful that this factor will operate in one manner in rural areas and in another way in urban areas. The above argument only points to the second explanation as the most plausible one. ' A child dead is a child forgotten ' and this is more so in rural areas. In rural areas the dead infant can be buried easily in any open area and unlike in municipal areas there is no need to go to an authorised burial ground. It appears likely that a low rate in the earlier age groups in rural areas is mostly due to omissions. If we now substitute the corresponding rates for urban areas for these age groups we get a total infant mortality rate of 110 for rural areas in 1960.

Before venturing on any suggestions for improvement of infant and maternal health in the State, the figures may be examined further. An analysis has been attempted below of the 19,972 infant deaths registered during 1960 in the 36 municipalities of Madras State with a population of 30,000 and above and having Health Officers.

TABLE 9-5

Infant deaths by age groups in selected Municipalities, 1960

Age period		Number	Percentage
Under 24 hours	...	1,632	8.2
24 hours—1 week	...	4,546	22.8
1 week—1 month	...	2,699	13.5
1 month—3 months	...	1,194	6.0
3 months—6 months	...	4,204	21.0
6 months—1 year	...	5,697	28.5
Total	...	19,972	100.0

These figures show the variations in the infant death rate in the different age periods in the selected municipalities which are known to have a better registration efficiency than the rest of the State. These percentages may therefore be taken to represent with more or less accuracy the conditions in other towns and in the districts. This table reveals that nearly 45% of the deaths occur among children under 1 month, 27% amongst those between one and six months and the remaining 28% among those between 6 and 12 months. It is obvious that if effective means could be taken to reduce the mortality in the first month or the neo-natal mortality as it is called, a very much greater saving of life could be obtained by dealing equally effectively during the other 11 months of the first year. It is commonly believed that the causes leading to death in the first month are non-preventible. Further, there is an enormous wastage of life due to abortions, miscarriages and still births as the factors causing such wastage are the same as those affecting the neo-natal group. In England, it is estimated that on an average one pregnancy in every eight terminates in abortion and there are three still births for every 100 live births. In Madras State, the corresponding figures are likely to be higher.

Still birth rate

The still birth rate per thousand live and still births for different areas of the State for 1956-60 are given in Table 9-6.

TABLE 9-6

Still birth rate for different areas, 1956-60

Area		1956	1957	1958	1959	1960
State	...	16.1	16.6	15.5	16.0	15.9
Rural	...	4.5	4.6	3.9	4.7	3.8
Urban	...	40.1	40.0	37.9	37.9	37.3
Municipal towns	...	46.7	46.5	43.7	43.7	42.0
Census towns	...	17.1	16.2	16.9	17.8	19.4

The still birth rate for the different areas has fluctuated widely and in general, we find a lower still birth rate for rural areas than for census towns, which is again lower than that of municipal areas. This is not probably true as the maternity service in rural areas is still inadequate compared to municipal areas. It is likely that many still births are not registered due to ignorance of people of their obligation to report still births. Among the municipalities, Palayamkottai has recorded the highest rate (97.2) in 1960, whereas the least rate has been recorded by Cumbum (2.93). While the latter figure can be dismissed as due to poor registration, the high rate

in Palayamkottai (97.2), Chingleput (83.6), Mannargudi (80.7) can be due to several cases of non-residential mothers who had no pre-natal care coming to the hospitals in these places at a very late stage. The rates for municipal areas for 1960 is 42.0 per thousand live and still births. Further, the Health survey carried out in 1951–52 in the Poonamallee area has revealed a still birth rate of 36.5 per thousand total births. Even if both these rates are taken as under-reported due to comparatively large number of omissions of still births, it is likely that the still birth rate of Madras State will be around 50 per thousand live and still births. Ceylon with its better registration had a rate of 50 around 1953–54.

Other rates

In recent years, there is a common tendency among demographers to distinguish even more clearly the pre-natal deaths from those attributable to post-natal environmental influences, by reference to deaths in the first week of life ; and such deaths per 1,000 related live births provide an early neo-natal mortality rate. These deaths combined with still births and rated to 1,000 total births can be regarded as measuring mortality at a period of time surrounding birth and may be described as peri-natal mortality. We may expect peri-natal mortality to be a sensitive index (under standard, social and climatic conditions) of the efficiency of obstetric services.

The computation of peri-natal mortality rate based on the data for municipalities with a population of 30,000 and over and having Health Officers is attempted in Table 9–7.

TABLE 9–7

Computation of Peri-natal mortality rate, 1957-60

Details	1957	1958	1959	1960
1. Deaths under one week (early neo-natal deaths) ...	3,955	3,767	4,027	6,178
2. Still births ...	6,750	6,697	7,531	9,499
3. Total 1+2 ...	10,705	10,464	11,558	15,677
4. Live births ...	128,438	129,911	141,154	215,439
5. Live and still births 2+4 ...	135,188	136,608	148,685	224,938
6. Peri-natal Mortality Rate 3/5 × 1,000.	79.2	76.6	77.7	69.7

The peri-natal mortality rate has the advantage that unlike its components, the still births and neo-natal rates, it is not likely to be disturbed by variations in the practice of recording, or in the actual timing of foetal deaths. If a foetus is regarded as surviving beyond intra-uterine existence a death is transferred from still birth to the early neo-natal category though the actual reality of the situation *viz.*, death around the point of delivery, is unaffected. This is quite an important point as the precise fixation of the time of foetal death is often difficult. The above figures seem to indicate a steady decline in the peri-natal mortality rate for the State since 1956. This is perhaps indicative of the growing efficiency of obstetric services in the State.

Total wastage

The Medical Text of the Registrar General's Annual Statistical Review for 1950 provides an interesting attempt to estimate the total loss of life during pregnancy and labour and the first year of life, by bringing into account the loss among embryos and foetuses prior to the twenty-eighth week of gestation which is not covered by registration data. It has been estimated from various sources reviewed by the Medical and Biological Committee of the Royal Commission on Population (1949) and the Inter-departmental Committee on Abortion that roughly, nine per cent of pregnancies in England and Wales are terminated by spontaneous abortion and a further four per cent are terminated by induced abortions *i.e.*, the total live and still births form 87% of the pregnancies. The percentage of abortions to total pregnancies in Madras State is not known with any degree of accuracy. A study conducted by the Gandhigram Pilot Health Project in a weaver community has revealed that for every 100 live births there are 30.5 induced abortions and 21.9 natural abortions bringing about a total of 52.4 abortions for every 100 live births. This appears to be quite an isolated example of a backward community and cannot hold good for the State as a whole. According to the Family Planning Survey conducted in 1963–64 in Madras City, for every hundred live and still births, there are 13 abortions. It is not known how many of them are induced abortions. The selected field studies conducted in different parts of India indicate 20 abortions both natural and induced for every 100 live and still births, which has therefore been adopted for our calculations. From this, the total number of pregnancies can be estimated by dividing the number of live and still births by this proportion. Using this along with the number of abortions, still births, neo-natal deaths and post neo-natal deaths, the total reproductive wastage can be computed as follows :—

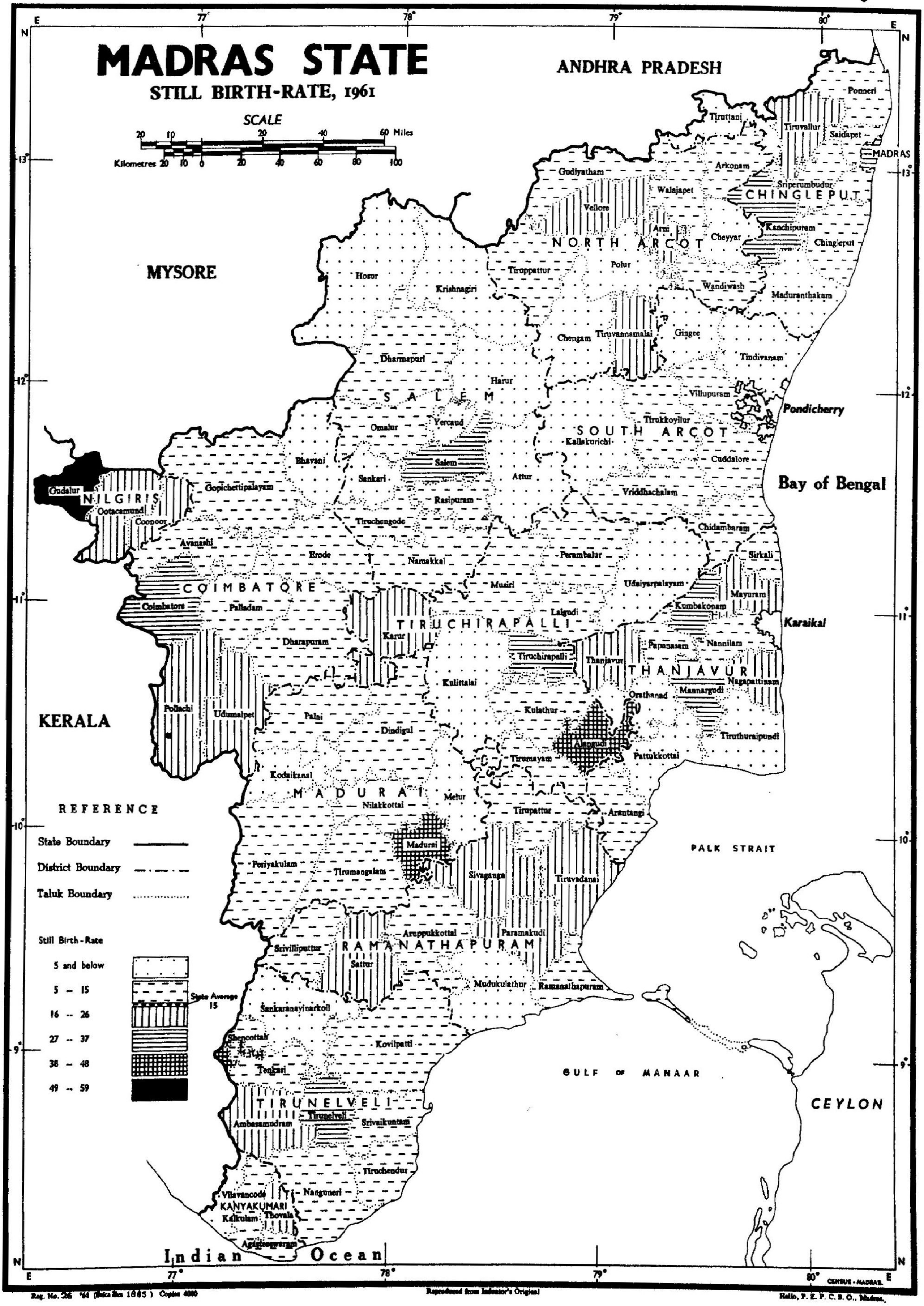


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TABLE 9-8

Computation of reproductive wastage for municipalities with 30,000 and above and having Health Officers

	1957	1958	1959	1960
1. Abortions ...	27,038	27,322	29,737	44,988
2. Still births ...	6,750	6,697	7,531	9,499
3. Neo-natal deaths	5,812	5,387	5,747	8,877
4. Post neo-natal deaths ...	6,642	6,045	6,033	11,095
Total reproductive wastage ...	46,242	45,451	49,048	74,459
Rate per thousand pregnancies ...	274	266	264	265

The total reproductive wastage works out to 265 per thousand live and still births in 1961, whereas the corresponding rate for England and Wales for 1950 was only 176.

The findings of the Poonamallee Health Survey, 1951-52

The Director of Public Health, Madras conducted a survey in 1951 in the Poonamallee Health Unit area (36 revenue villages covering 35 square miles) to assess the extent of infant mortality rate. An important aspect of this survey is a significant methodological contribution to the study of infant mortality, which is perhaps one of the ticklish subjects of study in demography. The approach consisted of an observation of all expectant mothers registered in the health centres of the Unit and then following them up through their delivery till the child completed one year of life. The infants born between the period 15th August, 1951 and 14th August 1952 formed the cohort of infants observed and followed up till they completed one year. In all, 1,506 infants were followed up. However, some infants were lost to observation before they completed one year, because their parents had moved out of the Health Unit area.

The report of the survey supplied by the Director of Public Health has been added as an Appendix. The main results of the survey are summarised below :

(1) The ranges within which the infant mortality rate for the period under enquiry *viz.*, August 1951 to August 1952 are 137.59 and 344.68 per 1,000 live births. The true infant mortality rate is likely to be 140.92 per 1,000 live births. The infant mortality rates in the different infant age groups are as follows :—

TABLE 9-9

Infant Mortality Rate in Poonamallee Health Unit area, 1951-52

Age group		Rate per 1,000 live births
Under 1 month	...	45.70
1—6 months	...	63.39
6—12 months	...	31.83
Total	...	140.92

(2) The most important causes of infant deaths were as follows :

TABLE 9-10

Causes of infant deaths, 1951-52

Causes of deaths		No. of Infant deaths	Percentage to total
1. Intestinal intoxication	...	42	22.6
2. Asphyxia	...	26	14.0
3. Prematurity	...	23	12.4
4. Bronchitis	...	14	7.5
5. Pyogenic infection (skin)	...	13	7.0
6. Nutritional maladjustment	...	10	5.4

(3) The still birth rate obtained from the survey is 36.5 per thousand live and still births.

While these conclusions are important from the point of view of maternity and child birth, the survey also throws light on the extent of under registration of infant mortality rate. Sri Jain in his enquiries relating to 1951 Census has come to the conclusion that the Infant Mortality Rate for Madras State for 1941-51 decade should be of the order of 170 for males and 155 for females. He has derived this on the basis of an

algebraic process coupled with a reasoning on the extent of undercount in the components of Infant Mortality Rate *viz.*, live births and infant deaths. Now, it is possible to deduce the extent of under-statement of infant death rate by comparing the rate observed from the survey with those recorded by the registration agency. The recorded rate is 121 in 1952 whereas the rate observed from the survey was 141, or 16.6% higher than the registered rate. In 1951 the Poonamallee Health Unit had already functioned for 17 years and the area can be regarded as a typical area of the State, and the result can be applied to the whole rural areas of the State. In 1952, the registered infant death rate for rural areas of the State stood at 107 and if this is corrected with the above correction factor the true infant mortality rate for the rural areas of the State in 1952 works out to be 125 per 1,000 live births. If it is further assumed that this correction factor is applicable to the registered rate for 1960, we get an infant mortality rate of 108 for the rural areas of Madras State.

Maternal mortality

It has already been remarked that the death rates for females between the ages 15 and 29 are considerably higher than the corresponding rates among males. This higher incidence can be explained as being due to the diseases or accidents of pregnancy and child birth, as these ages include the greater part of the child bearing period.

The term 'maternal mortality' may be used in a number of different senses. It may include all deaths in women in whom pregnancy was a current or antecedent condition, or it may be restricted to those cases in which death was directly attributed to child birth. In the first instance, a pregnant woman dying from heart diseases from which she had always suffered would be included ; in the latter case she would be excluded on the grounds that the death was merely 'associated' with but not directly due to her pregnant condition. Maternal mortality also may either include or exclude deaths due to abortion ; such deaths are sometimes excluded on two grounds—first, that the number at risk is less well established than for pregnancies which run to term and secondly, that it is a risk of a different quality from that associated with child birth. The maternal mortality rate is therefore conventionally defined as the number of women dying from delivery or complications of pregnancy, child birth or puerperium during an interval of time (commonly a calendar year) per 1,000 live and still births occurring during the same period. In 1921, Russel has pointed out the unreliability of the statistics of maternal deaths from registration data, and on the basis of an analysis of a few places where registration was fairly well carried out, concluded that 12 to 15 maternal deaths (or an average of 13.5) occur from child birth among thousand births. This figure according to him "cannot be considered an underestimate as even in Great Britain, where large number of institutions for ante-natal and maternity relief are in existence, the corresponding figure was 4.7 per thousand births. A study of the records relating to the family histories of persons who have insured their lives in Indian Insurance Companies amply corroborates these figures. In a series of 750 of the latest policies examined in a Madras Company, no less than 380 deaths were recorded among the mothers and sisters of the insured persons in the age periods of 15–50, and 162 of these, or 44.4% were said to have been due to "child birth," and "puerperal fever." In some families nearly every female in these age periods had died of the above causes. These figures are probably as nearly accurate as they can be, and it is reasonable therefore to conclude that the calculated mortality figure given in the previous paragraph is more likely to be under than overestimated."

It is interesting to compare the maternal mortality picture of 1921 with that of today. For purposes of comparison, the tables of maternal mortality compiled by Russel are found to be useful. We find a maternal death rate of 0.1 for Chingleput and Madurai in 1921 and the highest recorded is 4.0 for Thanjavur. In the municipalities the rates have ranged from 0.5 in Vellore to 127 in Periyakulam. In almost all the rural towns no maternal deaths have been recorded. If at all these figures tell anything, they tell only about the unreliability of the data. The reasons are not far to seek. Only in 1920, the local authorities were required by government to make a separate return of registered maternal deaths in their areas. Normally, any new idea takes time to catch up and this is more so in the matter of registration. The poor maternal death registration in 1921 can be attributed to the very novelty of it, and there is reason to believe that the registration of maternal deaths has improved since then.

TABLE 9–11

Maternal Death Rates for Municipal, Non-Municipal and all areas in Madras State, 1960

District		Municipal	Non-municipal	All Areas
Madras	...	1.59	...	1.59
Chingleput	...	7.21	2.92	3.44
North Arcot	...	3.74	2.18	2.53
South Arcot	...	6.60	3.43	3.84

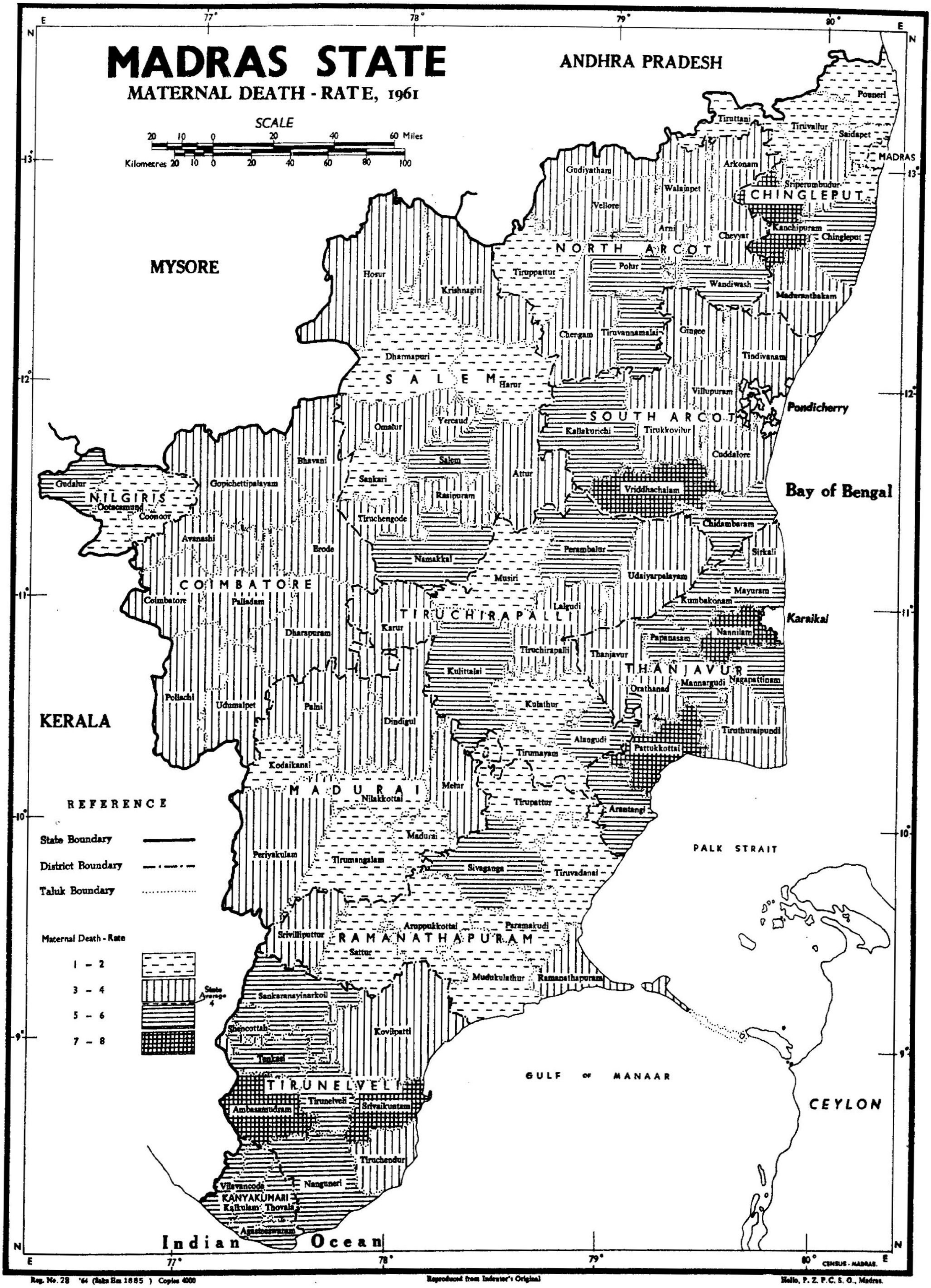

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TABLE 9-11—(*Contd.*)

Maternal Death Rates for Municipal, Non-Municipal and all areas in Madras State, 1960—(*Contd.*)

District		Municipal	Non-municipal	All Areas
Salem	...	4.29	2.36	2.97
Coimbatore	...	3.36	2.85	3.03
Nilgiris	...	3.26	2.74	2.90
Madurai	...	5.01	2.75	3.49
Tiruchirapalli	...	4.21	4.86	4.73
Thanjavur	...	5.84	4.34	4.74
Ramanathapuram	...	3.11	2.71	2.64
Tirunelveli	...	8.09	4.00	4.65
Kanyakumari	...	2.87	4.71	4.35
State	...	3.91	3.23	3.48

Table 9–11 gives the maternal death rates for Madras State in 1960. It is seen that the rates for municipal areas (excepting Madras City) are higher than the corresponding rates for non-municipal areas. This is mainly attributable to the loss of many deaths due to child-birth by their inclusion in other causes in non-municipal areas. In non-municipal areas, the registration is done by village headmen who are often illiterates and do not have any special medical skill to identify the causes of deaths with any degree of accuracy. In this respect the position in municipalities is better, though not perfect and hence more reliance can be placed on the municipal rather than the non-municipal rates. The facility for maternity and ante-natal and post-natal care is relatively less in non-municipal areas than in the municipal areas, and therefore the maternal death rates for these areas should be higher contrary to the picture given by the registration data.

The figure of maternal death rate of less than 2 per 1,000 births in Madras City is perhaps exceptional. This is due to the availability of medical attention and better levels of living in the city which are bound to be reflected in a lower maternal death rate. The maternal death rate of Madras City should only be regarded as a lower limit of that of the State and we should expect the rate for the State to be very much higher. In 1960, South Arcot has recorded a rate of 6.60, Chingleput 7.21 and Tirunelveli 8.09 and the rates for municipalities have ranged from 0.34 in Virudhunagar to 15.1 in Palayamkottai.

Table 9–12 gives the maternal mortality rate in the different areas from 1956–60.

TABLE 9–12

Maternal Mortality Rate in different areas, 1956-60

Area		1956	1957	1958	1959	1960
State	...	5.0	4.6	4.2	3.9	3.5
Rural	...	4.8	4.3	4.1	3.6	3.2
Urban	...	5.4	5.1	4.4	4.6	3.9
Municipal Towns	...	5.5	5.1	4.4	4.1	3.9
Census Towns	...	5.1	4.9	4.5	5.8	4.0

It appears from this table that the rural rate is lower than the urban rate. There is not much of variation between the municipal and census town rates, which is around 5 maternal deaths per thousand births. A rural rate of 3 maternal deaths per thousand births in contrast with this is highly improbable and should be due to the vagaries of the registration system. The average maternal death rates in the municipalities with a population of over 30,000 and having health officers is 6.2 in 1959. Taking into account all these facts, it is computed that there are 6 to 8 maternal deaths or an average of 7 per thousand births in the State. If we assume that the maternal death rate of 13.5 for 1921 suggested by Russel is correct, there is a decline of 50% in the maternal death rate during the forty year period 1921–61. The figures for 1941, 1951 and 1961 are given below :

TABLE 9–13

Maternal Death Rate

Year		Rate
1941	...	9.5
1951	...	5.7
1961	...	3.6

These statistics refer to deaths occurring at or about the time of child-birth, and although definite information is not available regarding the incidence of mortality during the period of pregnancy as a direct result or as a result of its complications, it has been computed that deaths from those causes amount to at least 8% of the deaths due to child birth. Assuming a birth rate of 35 per thousand, there are 11.55 lakh births in the State in 1961. If we further assume a maternal death rate of 7 per 1,000 births in 1961, there are 8,085 death from child birth. In addition to this enormous death-toll there must be large numbers of women who suffer from permanent disabilities and chronic invalidism. While death or invalidism of the mother is very often the cause of the death of the child, a high maternal mortality invariably contributes to a high death rate among children in the first few weeks of life. Strangely

enough, the number of deaths due to 'child birth' is higher than the number of deaths due to epidemic disease like Cholera, Small-pox and Plague, and yet people pay less attention to this.

Causes of Infantile Mortality

Table 9–14 gives the infant deaths classified by cause of death in municipalities with a population of 30,000 and over and having Health Officers in the State for 1956–60. It is seen that congenital debility, malformation and premature birth account for 36.9% and convulsions account for 19.6% of the infant deaths. This is followed by dysentery and diarrhoea which account for 4.1% and 5.6% respectively. The classification of cause of death followed in this table is the one adopted for all deaths and therefore this classification does not give a complete picture of the causes of infant mortality. Data are available in respect of the Corporation of Madras, wherein infants born in a given year is followed for one year and the deaths and the causes for them are noted. The data are presented in Table 9–15. This table indicates that Dysentery, Diarrhoea and other diseases of the alimentary system together contribute to the largest percentage of the infant deaths noted (33.0%). Prematurity and Asphyxia contribute to 19·8% of the deaths in 1954–61. According to medical opinion, the majority of the deaths during the first month of life are due to developmental conditions, such as premature birth, congenital defects, debility, marasumus, atrophy and lack of breast milk. We find that congenital debility, malformation and premature birth account for majority of deaths during the first month. Most of the deaths can be put down to causes which exert their fatal influence on the unborn child through the parent. In other words, all the evidence points to something radically wrong with the conditions under which the expectant women have to live.

TABLE 9–14

Infant deaths as per detailed causes in Municipalities with a population of 30,000 and above and having Health Officers, 1956-60

	1956	1957	1958	1959	1960	1956–60	Percentage
Infectious Diseases							
Cholera	...	1	1	...	...	2	0.003
Plague	...	...	...	...	...	...	...
Small pox	27	145	72	37	153	434	0.64
Measles	17	16	5	5	2	45	0.07
Chicken pox	1	5	4	...	...	10	0.01
Typhoid or Enteric fever ...	3	6	7	1	...	17	0.03
Diphtheria	31	19	38	31	37	156	0.23
Others	2	8	3	1	20	34	0.05
Fevers							
Malaria	2	...	1	1	...	4	0.01
Influenza	5	1	...	1	1	8	0.01
Relapsing fever	...	...	...	...	...	...	...
Kala Azar	...	...	...	...	...	...	...
Rheumatic fever	...	...	...	1	...	1	0.001
Other fevers	263	397	356	399	707	2,122	3.13

TABLE 9-14—(*Contd.*)

Infant deaths as per detailed causes in Municipalities with a population of 30,000 and above and having Health Officers, 1956-60--(*Contd.*)

	1956	1957	1958	1959	1960	1956–60	Percentage
Respiratory Diseases							
Tuberculosis of lungs ...	1	2	3	5	26	37	0.05
Pneumonia	1,031	956	825	764	2,426	6,002	8.85
Others	770	781	792	743	1,422	4,508	6.64
Alimentary Diseases							
Dysentery	424	452	501	515	874	2,766	4.08
Diarrhoea	672	663	612	536	1,317	3,800	5.60
Others	135	145	80	106	360	826	1.22
Diseases of the liver							
Cirrhosis	95	89	96	68	131	479	0.71
Others	66	69	65	49	63	312	0.46
Circulatory system							
Heart diseases	18	19	15	15	21	88	0.13
Arterio-scierosis	1	...	...	...	...	1	0.001
Others	34	31	38	47	75	225	0.33
Genito-urinary diseases excluding V.D.							
Bright's diseases	12	4	2	7	6	31	0.05
Others	3	2	2	7	22	36	0.05
Venereal diseases							
Syphilis	7	11	4	6	11	39	0.06
Gonorrhoea	32	67	...	...	7	106	0.16
Others	2	6	2	...	3	13	0.02
Diseases of the nervous system							
Convulsions	2,867	2,773	2,497	2,577	2,563	13,277	19.57
Cerebral Haemorrhage (apoplexy) ...	10	78	1	7	8	104	0.15
Tetanus	46	38	42	51	109	286	0.42
Epilepsy	3	4	21	31	9	68	0.10
Others	29	50	72	69	203	423	0.62

TABLE 9-14—(*Contd.*)

Infant deaths as per detailed causes in Municipalities with a population of 30,000 and above and having Health Officers, 1956-60—(*Contd.*)

	1956	1957	1958	1959	1960	1956–60	Percentage
Accident of pregnancy and child birth							
Puerperal Sepsis	...	...	...	...	...	...	...
Abortion	...	...	...	...	...	...	...
Other accidents and diseases of pregnancy and parturition	...	69	39	7	12	127	0.19
Deficiency diseases							
Beri-Beri	...	...	2	1	...	3	0.004
Rickets	89	65	56	59	65	334	0.49
Others	79	51	42	38	157	367	0.54
Malignant diseases							
1. Alimentary Tract	3	...	1	...	1	5	0.01
2. Genito-urinary	...	...	...	...	1	1	0.001
3. Breast	...	...	...	...	...	...	...
4. Other regions	6	2	3	6	11	28	0.04
5. Ankylostomiasis	...	...	1	3	3	7	0.01
6. Diabetes	1	...	...	...	1	2	0.003
7. Leprosy	...	...	...	...	...	...	...
8. Alcoholism	...	...	...	...	...	...	...
9. Congenital debility and malformation, premature birth ...	4,752	4,546	4,302	4,508	6,925	25,033	36.90
10. Rabies	...	...	...	...	...	...	...
11. Wounds and accidents ...	27	16	14	21	23	101	0.15
12. Snake-bite and scorpion-sting, etc....	...	1	1	...	2	4	0.01
13. Killed by wild beasts ...	...	...	...	...	...	...	...
14. Suicides	...	...	...	...	...	...	...
15. Poisons	2	1	1	...	2	6	0.01
16. Old age	...	...	...	...	...	...	...
17. All other causes	641	865	813	1,057	2,193	5,569	8.20
18. Total deaths from all causes ...	12,209	12,454	11,432	11,780	19,972	67,847	100.00

TABLE 9–15

Causes of deaths among infants born in the previous year and kept under observation during the first year of life, 1954-61

Particulars		Number	Percentage
Neo-natal Deaths			
Pre-maturity	...	3,516	14.5
Asphyxia-neonatorium	...	1,277	5.3
Birth Injuries	...	144	0.6
Congenital Malformation and their complications	...	165	0.7
Others	...	530	2.2
Infectious Diseases			
Cholera	...	27	0.1
Small pox	...	432	1.8
Diphtheria	...	47	0.2
Measles	...	42	0.2
Enteric fever	...	75	0.3
Anterior Poliomyelitis	...	10	0.04
Meningitis	...	23	0.1
Others	...	229	0.9
Fevers			
Malaria	...	22	0.1
Kala-azar	...	2	0.01
Others	...	1,621	6.7
Diseases of Respiratory System			
Tuberculosis of Lungs	...	26	0.1
Pneumonia	...	3,411	14.1
Others	...	681	2.8
Diseases of Alimentary System			
Diarrhoea	...	6,600	27.2
Dysentery	...	1,120	4.6
Others	...	297	1.2

TABLE 9–15—(*Contd.*)

Causes of deaths among infants born in the previous year and kept under observation during the first year of life, 1954-61—(*Contd.*)

Particulars		Number	Percentage
Diseases of Liver			
Cirrhosis	...	45	0.2
Others	...	37	0.2
Diseases of Urinary System			
Nephritis	...	74	0.3
Others	...	29	0.1
Venereal diseases	...	133	0.5
Diseases of the nervous system			
Convulsions	...	927	3.8
Tetanus	...	9	0.04
T. B. Meningitis	...	2	0.01
Others	...	75	0.3
Deficiency diseases			
Rickets	...	170	0.7
Malnutrition	...	1,090	4.5
Others	...	167	0.7
General causes			
Septicaemia and Pyalaemia	...	170	0.7
Accidents, injuries, etc.	...	12	0.05
Snake bite or scorpion stings	...	4	0.02
Other causes	...	348	1.4
Causes not known	...	666	2.7
Total	...	24,255	100.00

The same factors also give rise to numberless still births which escape registration under the present circumstances.

Among the major causes of infant mortality found in Indian Public Health Satistics is the general description 'diseases of the nervous system.' In nearly every case this means 'convulsions', but under the present system of registration the outstanding symptom, which marks the underlying true cause of cerebral irritability, has to be accepted. The factors, leading to convulsions are (1) reflex causes originating in the intestinal tract, (2) acute infectious diseases, including respiratory troubles, and (3) malnutrition and inherited debility. The total number of registered cases under convulsions in 1960 in Municipalities with population over 30,000 and having Health Officers is 2,563 out of the 19,972 cases or 12.8 % and most of these deaths occurred during the first month of life. The basic cause must therefore be some factor exerting its greatest influence during the first month, and this is likely to be malnutrition or debility on the part of the mother or the infant.

In 1921, Russel had enumerated the principal factors responsible for this neo-natal mortality as "(1) the marriage of immature females, (2) constant exposure to insanitary surroundings and particularly the lack of fresh air, (3) poverty with lack of proper food and resultant anaemia and debility in the mothers." Of these, the first factor *viz.*, marriage of immature females is likely to have less force today than in 1921 since the marriage of immature women is considerably negligible today. There has been a steady rise in the age at marriage of females from 14.92 in 1931 to 18.14 in 1961. As regards the remaining two factors the conclusions of Russel hold good even today.

"When the mother is poorly developed or mis-shapen as a result of rickets or similar disease, difficult labour with all its dangers is certain to occur. The only available aid is at the hand of ignorant dhais and barber women and as a result only too often mother and infant perish. Even where labour is normal, ignorant interference often produces similar fatalities, for the most curious superstitions still hold good as regard the treatment of parturient women and newly born infants." Alcohol and syphillis also play a more important part in the production of a high infantile mortality, especially in the lower classes, than one may care to believe but hospital statistics point unmistakably to this conclusion.

The first month is, therefore, the most dangerous in the life of the child, and in order to reduce the death rate during this period it is the expectant mother who requires attention and treatment. To wait until the child is born is to wait too long.

Amongst the causes which lead to high rates of infant mortality during the remaining eleven months of the first year of life, ignorance and social customs may be given first place. The great majority of the mothers are inexperienced and totally ignorant of mother craft, and being illiterate have no chance of learning the art of child welfare. The prejudices and superstitions associated with the social conditions of the people lead to total disregard of the simplest rules of hygiene. Economic conditions aggravate the sanitary imperfections inseparable from overcrowded communities, and the general defects of housing, drainage, water-supply etc., constitute an environment extremely detrimental to both mothers and children.

The grinding poverty of the poorer classes in India is such that the majority of infants probably suffer from bad feeding especially as the badly nourished mother finds herself only too often unable to provide her baby with a proper supply of good breast milk. The Madrasi mother very often loads the delicate stomach of her infant with rice water, or with the food prepared for the older members of the family. Attention has been drawn in another connection (see Appendix I to Madras City Health Report for 1913) to the enormous sale of tinned, condensed, skimmed or separated milk in Madras Presidency and to the dangers involved in the general use of this valueless article as a food for infants. Fed so badly, acute intestinal trouble is extremely common. During 1921 in Madras City, 1,175 infants died of diarrhoea and dysentery, *i.e.*, 21.7% of the total infant mortality. Few of these deaths occur during the first month of life, and the rate steadily increases from the second to the twelfth month. Temperature and rainfall appear to have little or no relation to the monthly incidence of those deaths and the conclusion is that bad feeding is the main cause.

Where the infant constantly breaths foul air, undue exposure tends to produce bronchitis, pneumonia and similar lung conditions. Even in Madras with its equable climate, approximately 22% of the total infant mortality is recorded as due to "respiratory diseases," the majority of the cases occurring during the wet colder months of October, November and December.

Small-pox must also be mentioned as an ever present cause of infantile deaths in this Presidency. Approximately one-fourth of the annual mortality from this disease occurs among children under one year of age.

We have attempted a compilation of statistics relating to Maternity and Child Welfare in Madras

City which were not compiled before and we hope these figures will be of interest to both the Public Health authorities and research workers in the field of Maternity and Child-welfare. The figures are presented in Tables 9-16 to 9-26.

The following conclusions can be drawn from these tables :

(1) About 30% of maternal deaths can be attributed to causes associated with pregnancy whereas the rest are directly due to child-birth. Most of these maternal deaths occur with sepsis, haemorrhage or toxaemia.

(2) Among the associated causes, diseases of the arteries, veins and circulation are the most important.

(3) Expressed as a ratio of a lakh of maternities, we find the highest rate (25.2) in the age group 20-24; the curve is a bell shaped one starting with a lower rate among those under 20, reaches a maximum in 20-24 and tapers off in subsequent age groups. The rate is high under toxaemia and haemorrhage.

(4) In the 15-19 age group maternal deaths are predominant among those with 1 and 2 children, and in the 20-24 age group the predominance is found among those with 2 and 3 children. In the later age groups the position is shifted to those women who have already had 5-9 children.

(5) 20 out of the 30 maternal deaths (or 67%) directly due to pregnancy are assessed as available. Among the 30 deaths associated with pregnancy, 13 or 43% are avoidable.

(6) Booked and unbooked cases of maternity in the child welfare centres are in the ratio 4 : 1, but the ratio for still birth and infant deaths are 2 : 1 and 3 : 1. This clearly shows that the still birth and infant death rates are higher among unbooked cases.

(7) Institutional confinements form 63.3% of all confinements in 1961, as against 56.8% in 1956. The percentage of domiciliary confinements attended only by midwives has diminished from 42% in 1956 to 36% in 1961. These figures reflect the expansion of institutional facilities in the City.

(8) The detailed causes of infant mortality among infants born in 1961 and followed up show that diarrhoea is the major cause contributing to 24.1% of the total infant deaths. Pneumonia comes next with 15.3% and Asphyxia Neonatorum leads to 8.1% of the infant deaths.

(9) There is a reduction in the reproductive wastage rate from 128.5 in 1956 to 103.4 in 1961.

TABLE 9-16

Maternal mortality rates per 1,000 live and still births distinguishing certain causes

Year	All maternal causes (excluding abortion)				Total	Associated with pregnancy	Total No. of live & still births
	With sepsis	With haemorrhage	With toxaemia	Others			
1956 ...	3	7	6	19	35	5	31,267
1957 ...	1	4	4	21	30	10	31,955
1958 ...	3	5	3	20	31	7	30,671
1959 ...	1	4	3	11	19	5	29,709
1960 ...	2	6	3	15	26	8	29,087
1961 ...	4	3	5	18	30	11	27,581

TABLE 9-17

Maternal Mortality (Excluding Abortion)

[International classification rubrics in brackets]

Sl. No.	Category	1956 No. of maternal deaths	1956 Rate per 1,000 live & still births	1957 No. of maternal deaths	1957 Rate per 1,000 live & still births	1958 No. of maternal deaths	1958 Rate per 1,000 live & still births	1959 No. of maternal deaths	1959 Rate per 1,000 live & still births	1960 No. of maternal deaths	1960 Rate per 1,000 live & still births	1961 No. of maternal deaths	1961 Rate per 1,000 live & still births
1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.	Toxaemia of Pregnancy (642) ...	3	0.096	2	0.063	...	...	...	...	2	0.068	...	...
2.	Haemorrhage of Pregnancy (643,644) ACH PPa ...	3	0.096	2	0.063	3	0.098	2	0.067	2	0.068	2	0.072
3.	Other complications of Pregnancy (645-649)—												
	(*a*) Anaemia ...	2	0.064	5	0.156	1	0.033	2	0.067	2	0.068	2	0.072
	(*b*) Heart failure ...	2	0.064	2	0.063	3	0.098	1	0.034	3	0.1	5	0.181
4.	Uncomplicated Delivery (660) V.D.H.	...	...	1	0.031	...	...	...	...	...	...	...	...
5.	Complicated delivery—												
	(*a*) with haemorrhage (670-672) ...	4	0.127	2	0.063	2	0.065	2	0.067	4	0.138	1	0.036
	(*b*) with disproportion or prolonged labour of other origin (673-675) ...	...	...	...	...	...	...	...	...	...	...	...	...
	(*c*) Other (676-678) Retained Placenta ...	6	0.192	2	0.063	4	0.13	1	0.034	1	0.034	4	0.145
	Obstetric shock ...	5	0.16	2	0.063	9	0.29	3	0.1	1	0.034	1	0.36

6. Sepsis of pregnancy, child birth & puerperim including puerperal thrombosis and embolism (640, 641, 681, 682, 684) ...	3	0.096	1	0.031	3	0.098	1	0.034	2	0.068	4	0.145
7. Puerperal toxaemia (Mania) (685, 686).	1	0.032	...	...	...	...	...	...	...	...	1	0.036
8. Miscellaneous :												
(*a*) Eclampsia ...	2	0.064	2	0.063	3	0.098	3	0.1	1	0.034	4	0.145
(*b*) Typhoid ...	2	0.064	...	...	...	...	...	...	2	0.068	...	...
(*c*) P.U.C. ...	2	0.064	4	0.125	1	0.033	...	...	1	0.034	1	0.036
(*d*) Maneinetis ...	...	...	...	...	...	...	1	0.034	2	0.068	...	...
(*e*) Dysentery ...	...	...	1	...	...	...	...	...	2	0.068	2	0.072
(*f*) Cholaemia ...	...	...	1	...	...	...	...	...	...	...	...	...
(*g*) Rupture Uterus ...	...	...	2	...	1	...	1	0.034	...	...	3	0.109
(*h*) Small pox ...	...	...	1	...	...	...	...	...	...	...	...	...
(*i*) Renal Failure ...	...	...	...	...	1	...	...	...	1	0.034	...	...
(*j*) Pneumonia ...	...	...	...	...	...	...	1	0.034	...	...	...	...
(*k*) Tuberculosis ...	...	...	...	...	...	...	1	0.034	...	...	...	...
9. TOTAL MATERNAL CAUSES ...	35	1.12	30	0.94	31	1.01	19	0.64	26	0.8	30	1.09

TABLE 9–18

Deaths of women not classified under pregnancy or child bearing but certified as associated therewith, 1956-61

Causes	1956	1957	1958	1959	1960	1961
1. Tuberculosis	...	...	...	...	...	...
2. Other infections and bacterial diseases (Small-pox)	1	...	1	1	...	...
3. Neoplasms	...	...	...	...	...	...
4. Diabetes	...	...	...	...	...	...
5. Other allergic and endocrine ...	...	1	...	...	...	...
6. Diseases of blood	...	...	...	...	...	...
7. Diseases of central nervous system ...	...	...	1	...	...	2
8. Mitral valve disease... ...	...	1	...	...	...	...
9. Other heart disease	...	...	...	...	...	...
10. Diseases of arteries, etc. ...	4	7	4	4	6	7
11. Pneumonia	...	...	...	...	...	...
12. Other respiratory diseases ...	...	...	...	...	...	...
13. Diseases of digestive system ...	...	1	...	...	2	2
14. Nephritis and Nephrosis ...	...	...	1	...	...	...
15. Congenital malformation ...	...	...	...	...	...	...
16. Violence	...	...	...	...	...	...
17. Others	...	...	...	...	...	...
Total ...	5	10	7	5	8	11

TABLE 9–19

Deaths per 100,000 Maternities in 1956-60

Code No.	Causes of death	Under 20	20—24	25—29	30—34	35—39	40—44	45+	All Ages
146.	Haemorrhage—								
	(*a*) Placenta Praevia ...	...	...	...	...	1.4	0.7	...	3
	(*b*) Premature separation ...	0.7	2.8	2.1	1.4	...	...	...	10
	(*c*), (*d*) Other haemorrhage ...	5.6	3.5	5.6	2.8	5.6	...	...	33
147.	Infection—								
	(*a*), (*b*) General and Local ...	0.7	0.7	...	...	...	...	...	2
	(*c*) Thrombophlebitis ...	0.7	...	...	...	...	...	...	1
	(*d*) Embolism, Sudden death ...	0.7	...	1.4	0.7	...	0.7	...	5
148.	Toxaemia—								
	(*a*) Eclampsis	4.9	1.4	1.4	0.7	...	...	...	12
	(*b*) Albuminaria etc.... ...	0.7	2.1	...	0.7	...	...	...	5
	(*c*) Acute yellow atrophy ...	...	0.7	...	0.7	...	...	...	2
	(*d*) Other toxaemia	0.7	2.8	2.8	1.4	1.4	...	...	13
149.	Other accidents of child-birth ...	0.7	1.4	1.4	0.7	...	...	...	6
150.	Other puerperal conditions ...	6.3	9.8	8.4	5.6	4.2	...	...	49
146–150	Total complications of child-birth and puerperium	21.7	25.2	23.1	14.7	12.6	1.4	...	98.7
	Ratio of rate to that for ages under 20...	1.0	1.2	1.1	0.7	0.6	...	...	4.5

TABLE 9-20

Maternal mortality per 1,000 live and still births, 1956-60

Previous children	15—19	20—24	25—29	30—34	35—44	Total
0 ...	...	...	...	...	...	...
1 ...	20	7	2	...	...	29
2 ...	11	14	...	...	...	25
3 ...	...	10	9	...	...	19
4 ...	...	5	8	6	1	20
5—9 ...	...	...	14	15	18	47
10—14 ...	...	...	...	...	1	1
Total ...	31	36	33	21	20	141

TABLE 9-21

Deaths ascribed to pregnancy and/or child birth

Cause of deaths	Assessment of avoidability			Total	Per-centage
	Avoi-dable	Unavoi-dable	Doubt-ful		
Toxaemia :					
Eclampsia ...	4	...	...	4	13.3
Haemorrhage :					
P.P.H. ...	1	...	...	1	3.3
Accidental A.R.H. ...	2	...	...	2	6.7
Pulmonary Embolism :					
Thrombotic	...	2	...	2	6.7
Amnictic ...	...	2	...	2	6.7
Obstetric shock	...	1	...	1	3.3
Rupture of uterus	3	...	...	3	10.0
Other conditions, Dysentery ...	2	...	...	2	6.7
Puerperal Infection (Malaria) ...	1	...	...	1	3.3
Ectopic gestation. P.V.O. Abortion	...	...	1	1	3.3
Anaemia	2	...	...	2	6.7
Criminal H-1 Failure	5	...	...	5	16.7
Other retained placenta ...	...	4	...	4	13.3
Total ...	20	9	1	30	100.0

TABLE 9-22

Deaths associated with pregnancy and child birth, 1961

Cause of deaths	No.	Percen-tage
Avoidable :		
Dysentery	2	6.7
Rupture uterus	4	13.3
Anaemia	1	3.3
Accidental Haemorrhage	2	6.7
Puerperal Maina	1	3.3
Eclampsia	3	10.0
	13	43.3
Unavoidable :		
Cerebral Thrombosis	2	6.7
Retained Placenta	4	13.3
Post Partum Haemorrhage	1	3.3
Pulmonary Embolism	2	6.7
Heart failure	6	20.0
Obstetric Shock	1	3.3
	16	53.3
Doubtful :		
Other fevers	1	3.4
	1	3.4
Total ...	30	100.0

TABLE 9-23

Statistics taken from the clinical report of a maternity hospital for the period from 1956-61

	Hospital cases (Ward + out calls + U.C.)		B.W.C. Any other	Total	Rate
	Booked	Unbooked (Emergency)			
Total maternities	12,709	2,774	64	15,483	...
Deaths	4	8	...	12	...
Still births	231	114	...	345	22.28 @
Live births	12,478	2,660	...	15.138	977.72
Infant Deaths	1,269	379	...	1,648	108.87+
Neo-natal deaths	189	130	...	319	21.07+

Note : @ Per thousand live and still births.
+ Per thousand live births.

TABLE 9-24

Infant Mortality by cause of death among infants born in 1961 followed upto 1962

Cause of infant death	No.	Percentage
Prematurity ...	282	12.08
Asphyxia Neonatorum ...	190	8.14
Birth injuries ...	14	0.60
Congenital malformation ...	34	1.46
Small-pox ...	71	3.04
Diphtheria ...	3	0.13
Measles ...	15	0.64
Enteric fever ...	2	0.09
Meningitis ...	1	0.04
Malaria ...	3	0.13
Tuberculosis of lungs ...	3	0.13
Pneumonia ...	357	15.29
Diarrhoea ...	562	24.07
Dysentery ...	78	3.34

TABLE 9-24—(*Contd.*)

Infant Mortality by cause of death among infants born in 1961 followed upto 1962—(*Contd.*)

Cause of infant death	No.	Percentage
Nephritis ...	7	0.30
Cirrhosis ...	1	0.04
Congenital syphilis ...	8	0.34
Convulsion ...	58	2.48
Tetanus ...	1	0.04
Rickets ...	6	0.26
Malnutrition ...	175	7.50
Septicaemia & Pyraemia ...	19	0.81
Accident injuries ...	5	0.21
Scorpion sting etc. ...	1	0.04
Undefined cases ...	439	18.80
All Causes ...	2,335	100.00

TABLE 9–25

Distribution of births by attendant, 1956-61

Attendant at birth		1956		1957		1958		1959		1960		1961	
		No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
Domiciliary confinements :													
Midwife only	...	13,158	42.1	12,682	39.7	12,975	42.3	11,246	37.9	10,903	37.5	9,805	35.5
Booked doctor	...	...	...	...	...	...	...	...	...	...	..	...	...
Midwife, medical aid	...	...	...	...	...	...	...	...	...	...	...	...	...
Ambulance nurse	...	...	...	...	...	...	...	...	...	...	...	...	...
Born before arrival of attendant	...	Complete records are not available.											
Attendant not known B.W.C.	...	346	1.1	347	1.1	307	1.0	326	1.1	336	1.1	307	1.1
All domiciliary confinements	...	13,504	43.2	13,029	40.8	13,282	43.3	11,572	39.0	11,239	38.6	10,112	36.7
Institutional Confinements :													
Hospital or maternity home	...	16,132	51.6	17,378	54.4	15,953	52.0	16,502	55.5	15,882	54.6	15,505	56.2
Hospital Case	...	1,631	5.2	1,548	4.8	1,436	4.7	1,635	5.5	1,966	6.8	1,964	7.1
All institutional confinements	...	17,763	56.8	18,926	59.2	17,389	56.7	18,137	61.0	17,848	61.4	17,469	63.3
Total	...	31,267	100.0	31,955	100.0	30,671	100.0	29,709	100.0	29,087	100.0	27,581	100.0

TABLE 9-26

Indices of pregnancy wastage, 1956-61

Item		1956	1957	1958	1959	1960	1961
1. *Neo-natal deaths (under 4 weeks)*							
Number	...	1,060	946	871	815	800	777
Rate*	...	34.7	30.34	29.1	28.04	28.09	28.7
2. *Post neo-natal deaths (over 4 weeks & under 1 year)*							
Number	...	2,248	2,288	2,108	1,949	1,837	1,558
Rate*	...	73.56	73.4	70.3	67.05	64.5	57.56
3. *Early neo-natal deaths (under 1 week)*							
Number	...	687	607	565	527	546	510
Rate*	...	22.48	19.5	18.8	18.13	19.2	18.84
4. *Still births*							
Number	...	710	783	699	644	607	517
Rate†	...	22.7	24.5	22.8	21.7	20.86	18.74
5. *Perinatal mortality (still births/Deaths under 1 week):*							
Number	...	1,397	1,390	1,264	1,171	1,153	1,027
Rate†	...	44.7	43.5	41.2	39.41	39.64	37.23
6. *Abortions*							
Number	...	No records maintained.					
Rate†	...						
7. *Reproductive wastage (Abortions, Still births, neo-natal deaths, post neo-natal deaths)*							
Number	...	4,018	4,017	3,678	3,408	3,244	2,852
Rate†	...	128.5	125.7	119.62	114.71	111.52	103.4

Note: *per 1,000 live births. †per 1,000 live and still births.

With these comments we leave the reader to draw his own inferences regarding the state of maternal and child health in the State and their determinants as well as consequences. One thing on which there can be no two opinions is that the level of maternal and child health leaves much to be desired, but we will be running into disputable grounds if we venture into suggestions for their improvement. This is a matter for further investigation by public health experts and social workers and we hope this discussion will stimulate interest on this very important problem.

Maternal morbidity

The sickness or ailment associated with pregnancy and child birth is called maternal morbidity. The following table gives the number of cases with different ailments diagnosed by the child welfare centres in Madras City in 1961.

TABLE 9–27

Maternal morbidity statistics of child welfare centres of Madras City, 1961

Details		No.	Percentage to total
Antepartum Complications :			
Accidental haemorrhage	...	150	2.0
Placenta praevia	...	18	0.2
Anaemia	...	1,147	15.4
Abnormal presentation	...	319	4.3
Hydatidiform mole	...	6	0.1
Ectopic Gestation	...	11	0.1
Intra & Postpartum Complications :			
Placenta praevia	...	...	...
Retained placenta	...	48	0.6
Postpartum haemorrhage	...	223	3.0
Anatomical abnormality-contracted pelvis	...	28	0.4
Malposition and disproportion	...	47	0.6
Tedious labour, delayed & 2nd stage		935	12.6
Perineal and cervical lacerations	...	990	13.3
Complications during puerperium :			
Urinary complications	...	76	1.0
Puerperal sepsis	...	80	1.1
Phlebitis, Thrombosis	...	2	0.03
Pyrexia	...	682	9.2
Uterine disorders	...	82	1.1
Puerperal Toxaemia	...	106	1.4
Anaemia	...	1,574	21.2
Psychosis	...	14	0.2
Diseases of Breasts	...	77	1.0
Other diseases	...	834	11.2
Total	...	7,449	100.0

It is seen that anaemia in both anti-partum complications and complications during puerperium ranks first with 36.6% of the total cases. Other major morbidity are puerperal and cervical lacerations, tedious labour, delayed and second stage, each constituting 13% of the total cases in 1961.

Among the pre-natal cases registered in the City of Madras in 1961, the following ailments of pregnancy are recorded.

TABLE 9–28

Pre-natal cases registered in the City of Madras, 1961

Details		No.	Percentage to total
Cardio Vascular Diseases :			
Valvular diseases of the heart	...	50	0.15
Hypertension	...	28	0.08
Varicose Veins	...	15	0.04
Respiratory Diseases :			
Bronchitis	...	923	2.72
Pneumonia	...	7	0.02
Pulmonary Tuberculosis	...	18	0.05
Asthma	...	72	0.21
Alimentary Tract Diseases :			
Constipation	...	709	2.09
Dyspepsia	...	1,570	4.63
Diarrhoea	...	158	0.47
Dysentery	...	158	0.47
Diseases of the Urinary Tract :			
Scanty Micturition & Retention of urine	...	662	1.95
Albuminovia	...	132	0.39
Pyelitis	...	20	0.06
Toxaemia of Pregnancy :			
Pre-Elamptic Toxaemia	...	549	1.62
Eclampsia	...	4	0.01
Acute Yellow Atrophy of the Liver (Jaundice)	...	...	...
General Anasarea	...	137	0.40

TABLE 9-28—(*Contd.*)

Pre-natal cases registered in the City of Madras, 1961—(*Contd.*)

Details		No.	Percentage to total
Deficiency Diseases :			
Calcium Deficiency	...	157	0.46
Vitamin Deficiency	...	4,191	12.36
Other Nutritional Deficiency	...	323	0.95
Pyrexias :			
Influenza	...	241	0.71
Malaria	...	11	0.03
Rheumatism	...	41	0.12
Debility :			
General Debility (Emaciation)	...	1,132	3.34
Specific Diseases :			
Skin Diseases	...	202	0.60
Ear, Nose, Throat	...	65	0.19
VD—Syphilis, Gonorrhoea	...	308	0.91
Lucorrhoea	...	70	0.21
Other Diseases and Abnormalities of Pregnancy :			
Morning Sickness	...	135	0.40
Anaemia	...	5,116	15.09
Hydraminor	...	26	0.08
Antepartum/Haemorrhage	...	45	0.13
Breast Abscess	...	11	0.03
Normal	...	14,276	42.11
Other Diseases	...	2,345	6.92
Total	...	33,907	100.00

Out of the 33,907 cases examined, 14,276 are stated to be normal. Among the remaining 19,631 cases, 5,116 cases or approximately 15.1% suffer from anaemia and another 4,191 or 12.4% suffer from vitamin deficiency. Dyspepsia accounts for 4.6% and general debility accounts for 3.3% of the cases.

Causes of maternal mortality

The discussion above about the maternal morbidity is intended to throw light on the causes of maternal mortality of which little data are available. In Table 9-29 causes of death among cases brought to the child welfare centres in 1951-61 are given.

TABLE 9-29

Causes of death among cases brought to child welfare centre, 1951-61 (Madras City)

Causes of death		No.	Percentage
Cardio Vascular diseases :			
Vascular diseases of Heart	...	5	1.2
Heart failure	...	31	7.5
Anaemia	...	25	6.0
Respiratory diseases :			
Pneumonia	...	6	1.4
Tuberculosis	...	9	2.2
Alimentary diseases :			
Tubercular enteritis	...	6	1.4
Dysentery	...	16	3.9
Intestinal obstruction	...	3	0.7
Urinary Diseases :			
Renal failure	...	4	1.0
Toxaemias :			
Pre-eclamptic toxaemia	...	19	4.6
Cholaemia	...	3	0.7
Cerebral Thrombosis	...	9	2.2
Eclampsia	...	32	7.7
Haemorrhage :			
Accidental haemorrhage	...	27	6.5
Placenta Praevia	...	8	1.9
Intra & Postpartum haemorrhage		45	10.9
Retained Placenta	...	42	10.1

TABLE 9-29—(*Contd.*)

Causes of death among cases brought to child welfare centre, 1951–61 (Madras City)—(*Contd.*)

Causes of death		No.	Percentage
Shock :			
Obstetric shock	...	28	6.8
Post operative shock	...	16	3.9
Shock due to internal manipulation.		9	2.2
Ruptured uterus	...	13	3.1
Infectious diseases :			
Tetanus	...	2	0.5
Typhoid	...	4	1.0
Meningitis	...	5	1.2
Other Fevers	...	11	2.7
Small-pox, measles, etc.	...	10	2.4
Puerperal sepsis	...	18	4.3
Intra partum sepsis	...	2	0.5
Pulmonary embolism	...	4	1.0
Puerperalmania	...	2	0.5
Total	...	414	100.0

It appears that Intra and Post partum haemorrhage and Retained Placenta have each contributed to 10%. Any effort for the control of maternal mortality should be concentrated on these major ailments. By and large, it is obvious that many of the deaths are due to the insanitary conditions in which the expectant mothers live, coupled with poverty and ignorance. The women are often compelled to work until within an hour or two of their confinement and they invariably return to work long before they are physically fit to do so. Among these women, the rate of incidence of sickness and death during pregnancy and during child birth is bound to be high. This is the case with the lowest strata of the society; even among the moderately educated classes there is an apathy to avail of modern medical facilities at the time of delivery. The woman in travail is often shut up in a dark dirty room where neither light nor fresh air can gain admittance, and she is usually surrounded by a crowd of female relations who do not allow any new notions of sanitation or hygiene.

The majority of maternal deaths occur either during delivery or within a few days after delivery. The usual causes of deaths in these cases are puerperal fevers or sepsis exhaustion or shock due to difficult labours. The incidence of deaths in 1960 at child birth due to different causes in municipalities with population over 30,000 and having Health Officers is as follows :

TABLE 9-30

Maternal deaths due to detailed causes, 1960

Causes		No.	Percentage
Puerperal sepsis	...	184	19.4
Abortion	...	92	9.7
Other accidents of Pregnancy and Parturition	...	671	70.9
Total	...	947	100.0

Abortion leads to only 10% of the deaths whereas 19% is due to Puerperal sepsis and the remaining 71% is due to other accidents of pregnancy and child birth. According to Russel, 70% of the cases can be traced to Puerperal fevers, sepsis and other related factors and 99 out of 100 of these are due to the manner in which labour is conducted in India. " Every maternity hospital in India can produce numberless records of such cases, for it is the unfortunate custom to send the women to hospital only when the dhai has done her worst and death is imminent."

Tables 9-31 and 9-32 contain the statistics of births registered during 1961 in municipal areas and districts of the State respectively and the percentage attended by qualified midwives in the employment of government and local bodies. A few other agencies such as mission hospitals and private nursing homes exist mostly in major towns but the number conducted by them is small and may be taken as negligible. According to these figures, the average percentage of registered births attended by trained midwives and nurses is 40.4% for municipalities and 31.87% for the districts.

TABLE 9-31

Percentage of births attended by midwives in Municipalities, 1961

District	Municipality	No. of Midwives	No. of Labour cases attended	Average per Midwife	No. of Births regis-tered	Birth rate	Percentage of cases attended to total regd. births
Madras ...	Madras ...	290	27,581	95	72,237	41.8	38.2
Chingleput ...	Kancheepuram ...	10	1,565	157	3,863	41.7	40.5
	Tiruvallur ...	5	669	134	933	47.2	71.7
	Chingleput ...	3	398	133	1,895	72.9	21.0
	Tiruvottiyur ...	3	399	133	420	11.2	95.0
North Arcot ...	Vellore ...	10	1,211	121	6,948	61.1	17.4
	Tiruvannamalai ...	3	540	180	1,840	39.6	29.3
	Gudiyatham ...	3	902	301	2,302	45.7	39.2
	Vaniyambadi ...	3	702	234	1,731	41.1	40.6
	Tiruppathur ...	3	648	216	1,774	57.6	36.5
	Walajapet ...	1	129	129	814	61.8	15.8
	Ambur ...	3	731	244	1,616	41.0	45.2
	Arni ...	4	564	141	1,516	48.4	37.2
	Arkonam ...	1	244	244	920	30.0	26.5
	Arcot ...	2	379	190	705	28.2	53.8
	Ranipet ...	1	232	232	1,019	44.4	22.8
South Arcot ...	Cuddalore ...	7	860	123	3,598	45.4	23.9
	Chidambaram ...	4	896	224	2,088	51.3	42.9
	Villupuram ...	8	1,112	139	1,787	41.1	62.2
	Tindivanam ...	3	325	108	1,443	42.0	22.5
Salem ...	Salem ...	25	4,780	191	12,552	50.4	38.1
	Rasipuram ...	2	803	402	1,070	44.8	75.0
Coimbatore ...	Coimbatore ...	37	6,151	166	15,634	54.6	39.3
	Erode ...	10	1,738	174	3,878	52.6	44.8
	Tiruppur ...	15	2,714	181	3,295	41.3	82.4
	Pollachi ...	6	1,113	186	2,651	48.8	42.0
	Dharapuram ...	3	397	132	1,400	52.9	28.4
	Udumalpet ...	3	473	158	1,491	52.6	31.7
	Mettupalayam ...	3	489	163	1,818	49.8	26.9
	Gobichettipalayam ...	3	461	154	976	36.1	47.2
Nilgiris ...	Ootacamund ...	8	658	82	2,260	45.1	29.1
	Coonoor ...	6	400	67	1,357	44.2	29.5
Madurai ...	Madurai ...	67	10,985	164	19,726	46.4	55.7
	Dindigul ...	13	2,164	166	3,111	33.5	69.6
	Bodinayakanur ...	3	545	182	1,211	27.0	45.0
	Periyakulam ...	6	962	160	1,859	51.2	51.7

TABLE 9-31—(*Contd.*)

Percentage of births attended by midwives in Municipalities, 1961—(*Contd.*)

District	Municipality	No. of Midwives	No. of Labour cases attended	Average per Midwife	No. of Births regis-tered	Birth rate	Percentage of cases attended to total regd. births
Madurai—(*Contd.*) ...	Palani ...	6	750	125	1,692	42.5	44.3
	Cumbum ...	1	303	303	716	22.0	42.3
Tiruchirapalli ...	Tiruchirapalli ...	32	4,865	152	9,523	38.1	51.1
	Karur ...	5	583	117	2,056	40.7	28.4
	Srirangam ...	3	642	214	1,795	42.8	35.8
	Pudukottai ...	8	715	89	2,553	50.6	28.0
Thanjavur ...	Thanjavur ...	12	1,497	125	6,129	55.2	24.4
	Kumbakonam ...	8	1,817	227	5,280	57.0	34.4
	Nagapattinam ...	4	424	106	2,540	43.0	16.7
	Mayuram ...	5	901	180	2,614	50.9	34.5
	Mannargudi ...	4	739	185	2,304	68.6	32.1
	Tiruvarur ...	3	383	128	1,410	46.8	27.2
Ramanathapuram ...	Rajapalayam ...	5	829	166	2,232	31.3	37.1
	Srivilliputhur ...	5	1,164	233	1,558	33.3	74.7
	Virudhunagar ...	9	1,468	163	2,786	50.8	52.7
	Karaikudi ...	6	1,276	213	1,699	38.9	75.1
	Devakottai ...	2	300	150	980	38.4	30.6
	Sivakasi ...	4	829	207	1,097	35.7	75.6
	Aruppukottai ...	6	713	119	2,224	44.3	32.1
	Ramanathapuram ...	...	...	...	2,012	74.8	...
Tirunelveli ...	Tuticorin ...	16	2,848	178	4,549	36.6	62.6
	Tirunelveli ...	15	1,602	107	3,226	36.7	49.7
	Palayamkottai ...	4	631	158	3,155	61.9	20.0
	Melapalayam ...	2	443	222	689	17.8	64.3
	Shencottah ...	1	234	234	787	38.3	29.7
Kanyakumari ...	Nagercoil ...	10	1,586	159	4,037	38.0	39.3
	Colachel ...	1	98	98	463	29.5	21.2
	Kuzhithurai ...	1	147	147	553	40.3	26.6
	Padmanabhapuram ...	1	192	192	607	41.9	31.6
State ...	... ...	756	102,899	136	255,004	44.1	40.4

TABLE 9-32
Percentage of births attended by Midwives in each District, 1961

S. No.	Name of the District		No. of Midwives	No. of labour cases attended	Average per Midwife	No. of births registered	Birth rate	Percentage of cases attended by Midwives to the total registered births
1.	Madras	...	290	27,581	95	72,237	41.78	38.18
2.	Chingleput	...	205	20,280	99	55,545	25.29	36.51
3.	North Arcot	...	164	19,985	122	95,440	30.33	20.94
4.	South Arcot	...	124	18,114	146	69,556	22.82	26.04
5.	Salem	...	167	29,323	176	88,842	23.35	33.01
6.	Coimbatore	...	290	28,717	99	89,413	25.13	32.12
7.	Nilgiris	...	60	4,663	78	11,465	28.01	40.67
8.	Madurai	...	321	38,090	119	90,372	28.14	42.15
9.	Tiruchirapalli	...	181	20,972	116	81,069	25.41	25.87
10.	Thanjavur	...	204	18,648	91	80,085	24.67	23.29
11.	Ramanathapuram	...	231	24,443	106	59,053	24.38	41.39
12.	Tirunelveli	...	209	26,624	127	80,821	29.60	32.94
13.	Kanyakumari	...	57	10,165	178	28,556	28.64	35.60
	State	...	2,503	287,605	115	902,454	26.79	31.87

Much has been said and written of late regarding maternity and child welfare, but public interest on this subject is not reflected in the municipal reports, as shown by the percentage of recorded births attended by municipal midwives in the municipalities in the State in 1961. The figures are given below :

TABLE 9-33
Number and percentage of towns by extent of attendance by midwives

Percentage of recorded births attended by midwives		No.	Percentage
Nil	...	1	1.5
Under 10	...	...	...
10—19.9	...	3	4.6
20—29.9	...	18	27.7
30—39.9	...	16	24.6
40 & over	...	27	41.6
Total	...	65	100.0

This table clearly shows that even after a decade of planning in many municipalities the number of midwives is not adequate. This is a matter for serious concern and needs careful consideration of the health department and local bodies.

The result is that out of the 12 lakh of labour cases occurring every year, over 8 lakh of women deliver with the assistance of barbers' wives or dhais. Their ignorance of hygiene or even of cleanliness is stupendous and this will be clear when we realise that the dhai herself performs the duties of a physician, midwife and scavenger. Their methods, the instruments used by them and the medicines administered by them to the mother and child are crude and unscientific.

Policy implications

The discussion in this chapter will not be complete without drawing inferences which will be of value in planning and policy making. The following recommendations are made[1]:

(1) An adequate number of midwives and health visitors in each municipality and panchayat area may be appointed. The scheme can be linked with the family planning programme, since the Panchayats have already been assigned the responsibility for popularising methods of family planning. The number of midwives and health visitors required for each area can be calculated on the basis of a scale of one midwife for every 300 annual live births in the locality.

(2) The scheme of health visitors is functioning well in the child welfare centres of Madras City and this can very well be implemented in other municipalities and panchayats. Since the barber caste women and dhais cannot be totally eliminated in a short time especially when there is a dearth of trained midwives and health visitors, it is better to train them in modern methods of sanitation, hygiene, mother craft, etc. Gradually they should be replaced by qualified midwives and health visitors. But in the meanwhile, a system of compulsory registration of dhais should be introduced and all unregistered dhais should be prosecuted.

(3) Organisation of pre and post-natal care : Voluntary effort of the public should be enlisted to bring about greater awareness of the problems of pregnancy and child care. This is possible now more than ever before in view of the existence of a large number of social service organisations like Voluntary Health Services, Lions Clubs, Rotary Clubs, Y.M.C.A., etc., interested in welfare activities. Moreover in every town we have enough number of public spirited men, doctors and officials who would easily lend a helping hand to such efforts. Lakhs of rupees are spent every year on religious endowments and charities of various kinds, but relatively little goes towards maternity and child welfare. In conclusion, it is worth recalling the observations made by Russel in 1921.

" Emphasis has already been laid on the need for both ante-natal and post-natal work and on the close relationship which must exist between the measures adopted for the care of the mother and child respectively. The necessary measures can best be undertaken by the opening of ante-natal clinics and child welfare centres where the health of both mothers and infants can be systematically supervised. The ideal arrangement is for the midwife to do her own ante-natal visiting, but this is seldom possible in India. Moreover, in England, the child welfare centres and baby clinics were originally founded for consultation work only, but it was soon found that ante-natal work was essential if the expectant mother was to have the best chance of producing a healthy child, and the same arguments apply with even greater force in this country. No elaborate building or equipment is required. An ordinary house with two or three rooms and a verandah is all that is necessary but it ought to be situated in the centre of the area which it is intended to serve, so that the mothers may not have long distances to travel. The centre should be managed by a committee of ladies, the voluntary workers attending by turns. Probably to start with, it will be sufficient to open the centre only on two days a week, but experience will soon show which days and hours are most convenient to the mothers.

The main object is to encourage the women to repeat their visits to the Child Welfare Centre and it may be advisable to offer some form of light refreshment, and in this country it may even be necessary to provide substantial meals for a percentage of the women who attend. This ought not, however, be carried on to any extent unless absolutely unavoidable, as the ante-natal clinic and Child Welfare Centre must not be allowed to function as a charity for the distribution of material aid. Once the women begin to recognise the value of the clinic both to themselves and their infants they will be only too glad to attend and they will also recommend the place to their neighbours and friends.

To begin with, the unit of the child welfare scheme should be the municipality ; for local talent, local effort and local philanthropy may well combine to make the scheme a success. Moreover in municipalities one is more likely to obtain the advice of experts and the co-operation of both official and non-official agencies. When the municipal experiment has proved a success, it will be possible to introduce similar schemes in the district unions and the larger village."

CHAPTER X

HOSPITAL STATISTICS

The object of this chapter is two-fold:

(i) to focus attention on the need for rationalising the compilation of the statistics of medical institutions in the State, and

(ii) to indicate the mode of analysis and the ways and means of utilising the data in medical administration.

This is a field in which an objective effort is wanting, even though Madras has a long tradition in the compilation of hospital statistics. It would profit medical officers of hospitals to interest themselves in elementary statistical methods, to encourage statisticians to perfect methods particularly applicable to hospital administration and to learn to recognise problems which call for statistical judgement. There are a number of questions for which the medical officer of every hospital should find answers. Has the occupancy kept pace with the increase in the availability of beds ? What was the turn over ratio ? Can it be improved or are there staff difficulties preventing further reduction ? Do the disparities between waiting lists or out-patient attendances for different specialities suggest that there should be some reallocation of beds? Is hospital mortality higher than normal? A clear exposition of the methodological aspects of hospital statistics analysis is found in Elements of Vital Statistics by B. Benjamin and the discussion in this chapter is based on his approach.

Beds and bed usage

One of the fundamental problems in medical programmes is the assessment of demand for hospital beds. This depends upon three factors, one is the population served by the hospital, second is the incidence of illness severe enough to require hospital treatment and the third is the duration of hospital treatment. If for instance, the average duration of hospital stay is 20 days, then one bed will be used eighteen times in a year and will support an annual admission rate of 18. If 9,000 people require treatment every year, then 500 beds will be required to meet the total demand. If the available bed strength is short of this, then either some people are denied admission or provided admission without the requisite facilities. In actual practice, the estimation of bed demand is not as simple as this. Even if we know the incidence rate of illness, it is necessary to know the " population at risk " to arrive at the bed strength needed. It is difficult to determine with precision the catchment area of each hospital but we can nevertheless get the approximate area from which the bulk of the population is drawn.

The rate of incidence of illness requiring hospital treatment is not known, nor is it possible to determine this from the records of hospital admissions. But it appears that about 3% of the population will require hospital treatment every year. There are bound to be large sex and age differentials and also differentials in respect of important disease categories and separate specialist departments. It would therefore be necessary to measure the proportion of population in a given sex and age group for each disease. These rates when applied to the population at risk will give the estimates of bed needs.

Table 10-1 shows the average bed strength and the average daily number of in-patients in the hospitals of Madras State during 1956-60.

The percentage of occupancy given in columns (6) and (7) are obtained by expressing the average number of in-patients as a percentage of the bed strength. These figures indicate wide fluctuations in the percentage occupancy from year to year, but the percentage is well above 90 except in 1961. The bed strength available in each district is varying. Madras City ranks first in having 278 beds per lakh of population and Nilgiris district comes next with 171 beds per lakh of population. Salem district has the least bed strength, *viz.*, 28 per lakh of population followed by South Arcot district with 31 beds per lakh of population.

Another important index is the average duration of illness derived from hospital data. But unfortunately the figures of average duration of illness have been computed wrongly in the Report on the Working of Civil Dispensaries and Hospitals of Madras State published annually by the Director of Medical Services, Madras. This report gives the average duration of illness, separately for each hospital and then the total of those figures is shown as the average duration for each district and State. The simple arithmetical fact that sum of averages is not necessarily the average of sums is totally ignored, with the result that the published figures are useless for any study. The procedure

TABLE 10-1

Average bed strength and the average number of in-patients in Madras Hospitals, 1956-60

Year	Average bed strength		Average No. of in-patients per day		Percentage of occupancy	
	Men	Women	Men	Women	Men	Women
1	2	3	4	5	6	7
1956	9,412	9,409	10,264	10,000	109.1	106.3
1957	10,899	8,995	10,757	9,193	98.7	102.2
1958	10,083	9,932	10,117	9,495	100.3	95.6
1959	11,238	9,973	10,354	10,224	92.1	102.5
1960	11,715	10,473	10,899	9,643	93.0	92.1
1961	12,087	11,976	10,692	10,357	88.5	86.5

that should be followed is indicated below: Let d_1, d_2............d_n be the duration of illness of persons 1, 2............n, then the average duration of illness in the hospital is

$$\frac{\sum_{i=1}^{n} di}{n}$$

Similarly, if *d*ij is the duration of 'i' th person in 'j' th hospital, the average duration for all hospitals should be

$$\frac{\Sigma dij}{N}$$

where N is the total number of in-patients in all the hospitals put together. This can be done easily by providing a column for the total duration of stay, so that for the districts as well as State the average duration can be worked out by totalling the durations and then dividing this total by the total number of in-patients.

Working of the Civil Hospitals and Dispensaries in Madras State

The Director of Medical Services, Madras State brings out a publication annually, containing the administrative statistics of all the hospitals and dispensaries in the State. For the purpose of this publication, the medical institutions in the State are classified under the following categories:

- Class I—State Public
- Class II—State Special (*viz.*, Police, Forest, Canals, Railways and others)
- Class III—Local Fund & Municipal
- Class IV—Private Aided
- Class V—Private Non-Aided
- Class VI—Subsidised Rural Dispensaries.

Table 10-2 shows for 1956-61 details regarding the number of medical institutions in these categories classified further into (1) General, (2) Women only and (3) Specialist services. In Table 10-3 we have given the particulars of institutions in rural and urban areas. It appears that the expansion is quite marked in State Public category during 1956-61. Likewise the extension of medical facilities in rural areas has also made rapid strides during the last 6 years. In spite of this expansion, it appears that the number of medical institutions in rural areas is quite meagre considering the fact that 80% of our population live in the villages.

TABLE 10–2

Number of Civil Hospitals and Dispensaries in the State by Broad Categories, 1956-61

Class		1956			1957			1958			1959			1960			1961		
		General	For women only	Only specialist service	General	For women only	Only specialist service	General	For women only	Only specialist service	General	For women only	Only specialist service	General	For women only	Only specialist service	General	For women only	Only specialist service
I. State—Public :																			
(a) Hospital	...	107	5	4	103	8	3	116	8	3	159	6	9	174	14	13	222	14	14
(b) Dispensaries	...	52	...	2	66	1	6	89	1	5	87	1	...	166	1	1	136	8	4
II. State—Special :																			
(i) *Police :*																			
(a) Hospital	...	3	...	2	5	...	...	5	...	...	8	...	...	6	...	1	6	...	1
(b) Dispensaries	...	8	...	...	8	...	...	8	...	...	8	...	...	6	...	...	6	...	...
(ii) *Forest and Surveys :*																			
(a) Hospital	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
(b) Dispensaries	...	2	...	...	1	...	...	...	...	1	1	...	...	2	...	1	2	...	...
(iii) *Canals :*																			
(a) Hospital	...	2	...	...	2	...	...	2	...	...	2	...	...	...	...	...	2	...	...
(b) Dispensaries	...	4	...	...	6	...	...	6	...	...	5	...	1	9	...	...	4	...	...
(iv) *Railways :*																			
(a) Hospital	...	14	...	...	14	...	...	14	...	...	13	...	...	13	...	...	13	...	...
(b) Dispensaries	...	14	...	...	11	...	...	11	...	...	12	...	...	13	...	...	14	...	...
(v) *Others :*																			
(a) Hospital	...	1	...	...	1	...	...	4	...	...	9	...	...	10	...	...	16	...	...
(b) Dispensaries	...	16	...	...	16	...	...	21	...	...	14	...	...	6	...	...	5	...	...
III. Local & Municipal Funds (including village & Union Board, etc.) :																			
(a) Hospital	...	42	16	1	28	18	1	30	15	1	22	16	1	23	12	1	18	5	3
(b) Dispensaries	...	303	5	8	284	5	...	298	5	1	309	3	...	251	2	...	267	3	...
IV. Private—Aided :																			
(a) Hospital	...	11	4	6	14	3	6	16	3	4	18	1	7	17	1	7	14	3	10
(b) Dispensaries	...	7	...	...	8	...	2	9	...	1	4	...	1	7	...	...	4	...	...
V. Private—Non-Aided :																			
(a) Hospital	...	22	3	4	18	3	5	23	1	2	18	1	1	24	1	...	18	2	1
(b) Dispensaries	...	13	...	2	9	...	...	9	...	...	10	...	...	2	...	...	3	...	...
(i) *Under Govt. Supervision :*																			
(a) Hospital	...	...	...	...	1	...	...	1	...	...	3	...	...	3	...	...	...	...	1
(b) Dispensaries	...	...	...	...	...	...	...	...	...	...	1	...	...	...	...	...	3	...	...
(ii) *Not Under Govt. Supervision :*																			
(a) Hospital	...	7	...	1	4	...	...	4	...	...	5	...	...	2	2	1	2	...	2
(b) Dispensaries	...	4	...	...	7	...	...	7	...	...	10	...	...	7	4	...	2	4	...
Total	...	632	33	30	606	38	23	673	33	18	718	28	20	741	37	25	757	39	36

TABLE 10-3

Number of Civil Hospitals and Dispensaries in the State by different classes for rural and urban areas, 1956-61

Class	1956		1957		1958		1959		1960		1961	
	R	U	R	U	R	U	R	U	R	U	R	U
I. State—Public :												
(*a*) Hospitals ...	57	59	58	56	68	59	100	74	114	87	163	87
(*b*) Dispensaries ...	48	6	64	9	86	9	78	10	116	52	138	10
II. State—Special												
(i) *Police :*												
(*a*) Hospital ...	4	1	2	3	2	3	2	6	3	4	3	4
(*b*) Dispensaries.	5	3	2	6	2	6	4	4	3	3	3	3
(ii) *Forest and Surveys :*												
(*a*) Hospitals ...	...	...	...	...	...	...	...	...	...	...	...	...
(*b*) Dispensaries.	2	...	1	...	1	...	1	...	3	...	2	...
(iii) *Canals :*												
(*a*) Hospitals ...	2	...	2	...	2	...	2	...	...	...	2	...
(*b*) Dispensaries.	4	...	6	...	6	...	6	...	8	1	3	1
(iv) *Railways :*												
(*a*) Hospitals ...	5	9	4	10	4	10	4	9	5	8	5	8
(*b*) Dispensaries	5	9	4	7	4	7	4	8	10	3	9	5
(v) *Others :*												
(*a*) Hospitals ...	1	...	1	...	4	...	8	1	9	1	15	1
(*b*) Dispensaries	16	...	15	1	20	1	14	...	6	...	3	2
III. Local and Municipal Funds (including Village and Union Board, etc.)												
(*a*) Hospitals ...	36	23	31	16	33	13	25	14	20	16	5	21
(*b*) Dispensaries ...	230	86	219	70	225	79	230	82	209	44	186	84
IV. Private—Aided :												
(*a*) Hospitals ...	12	9	13	10	13	10	14	12	13	12	15	12
(*b*) Dispensaries ...	3	4	7	3	7	3	3	2	4	3	2	2
V. Private—Non-Aided :												
(*a*) Hospitals ...	20	9	19	7	19	7	11	9	17	8	14	7
(*b*) Dispensaries ...	13	2	4	5	4	5	9	1	1	1	2	1
(i) *Under Government Supervision :*												
(*a*) Hospitals ...	...	...	...	1	...	1	3	...	3	...	...	1
(*b*) Dispensaries.	...	...	...	...	...	...	...	1	...	...	3	...
(ii) *Not under Government Supervision :*												
(*a*) Hospitals ...	4	4	2	2	2	2	2	3	2	3	1	3
(*b*) Dispensaries	1	3	4	3	4	3	6	4	10	1	4	2
Total ...	468	227	458	209	506	218	526	240	556	247	578	254

Another important information available in this annual publication is the number of in-door and out-door patients treated in the different hospitals of the State, the number of beds available, average duration of illness, average daily attendance, etc., for each of the hospitals. The inaccuracy in the data on the average duration of illness has already been mentioned. However it appears that the data on the number of in and out-patients may be taken as fairly correct. The number of in-patients and the number of out-patients treated are given district-wise in Table 10-4 for the year 1961. The trend in the number of in and out-patients treated is evident from Table 10-5.

TABLE 10–4

Hospitalisation and other rates, 1961

District	Population 1961			Number of beds			No. of beds per lakh of population		
	Males	Females	Total	Males	Females	Total	Males	Females	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Madras ...	909,701	819,440	1,729,141	1,933	2,869	4,802	212	350	278
Chingleput ...	1,120,591	1,075,821	2,196,412	1,501	765	2,266	134	71	103
North Arcot ...	1,581,826	1,564,500	3,146,326	1,023	953	1,976	65	61	63
South Arcot ...	1,535,928	1,512,045	3,047,973	468	478	946	30	32	31
Salem ...	1,923,885	1,880,223	3,804,108	474	585	1,059	25	31	28
Coimbatore ...	1,809,591	1,747,880	3,557,471	1,117	1,252	2,369	62	72	67
Nilgiris ...	213,833	195,475	409,308	379	322	701	177	165	171
Madurai ...	1,607,229	1,603,998	3,211,227	964	873	1,837	60	54	57
Tiruchirapalli ...	1,588,429	1,601,649	3,190,078	702	560	1,262	44	35	40
Thanjavur ...	1,610,241	1,635,686	3,245,927	1,357	1,382	2,739	84	84	84
Ramanathapuram ...	1,175,769	1,246,019	2,421,788	577	688	1,265	49	55	52
Tirunelveli ...	1,330,220	1,400,059	2,730,279	686	672	1,358	52	48	50
Kanyakumari ...	503,735	493,180	996,915	906	577	1,483	180	117	149
State ...	16,910,978	16,775,975	33,686,953	12,087	11,976	24,063	71	71	71

TABLE 10-4—(*Contd.*)

Hospitalisation and other rates, 1961—(*Contd.*)

District		Number of in-door patients			Number of in-door patients per lakh of population		
		Males	Females	Total	Males	Females	Total
		(11)	(12)	(13)	(14)	(15)	(16)
Madras	...	59,771	111,837	171,608	6,570	13,648	9,924
Chingleput	...	14,981	15,541	30,522	1,337	1,445	1,390
North Arcot	...	26,394	35,894	62,288	1,669	2,294	1,980
South Arcot	...	18,900	21,613	40,513	1,231	1,429	1,329
Salem	...	17,111	26,404	43,515	889	1,404	1,144
Coimbatore	...	36,784	50,014	86,798	2,033	2,861	2,440
Nilgiris	...	7,952	10,517	18,469	3,719	5,380	4,512
Madurai	...	30,338	33,995	64,333	1,888	2,119	2,003
Tiruchirapalli	...	19,416	25,961	45,377	1,222	1,621	1,422
Thanjavur	...	25,229	49,977	75,206	1,567	3,055	2,317
Ramanathapuram	...	13,652	26,022	39,674	1,161	2,088	1,638
Tirunelveli	...	15,721	23,256	38,977	1,182	1,661	1,428
Kanyakumari	...	5,416	6,015	11,431	1,075	1,220	1,147
State	...	291,665	437,046	728,711	1,725	2,605	2,163

TABLE 10-4—(*Contd.*)

Hospitalisation and other rates, 1961—(*Contd.*)

District		Number of out-door patients			Number of out-door patients per lakh of population		
		Males	Females	Total	Males	Females	Total
		(17)	(18)	(19)	(20)	(21)	(22)
Madras	...	1,814,890	1,795,353	3,610,243	199,504	219,095	208,788
Chingleput	...	625,035	510,466	1,135,501	55,777	47,449	51,698
North Arcot	...	880,322	649,677	1,529,999	55,652	41,526	48,628
South Arcot	...	717,620	517,323	1,234,943	46,722	34,213	40,517
Salem	...	682,565	549,110	1,231,675	35,478	29,205	32,377
Coimbatore	...	774,489	669,502	1,443,991	42,799	38,304	40,590
Nilgiris	...	216,205	184,732	400,937	101,109	94,504	97,955
Madurai	...	686,548	610,767	1,297,315	42,716	38,078	40,399
Tiruchirapalli	...	606,868	509,670	1,116,538	38,206	31,822	35,000
Thanjavur	...	940,134	1,003,993	1,944,127	58,385	61,381	59,894
Ramanathapuram	...	489,905	531,394	1,021,299	41,667	42,647	42,171
Tirunelveli	...	614,242	603,438	1,217,680	46,176	43,101	44,599
Kanyakumari	...	286,074	340,173	626,247	56,791	68,975	62,818
State	...	9,334,897	8,475,598	17,810,495	55,200	50,522	52,871

TABLE 10-5

Trend in the number of cases treated

Year		In-patients			Out-patients		
		Men	Women	Children	Men	Women	Children
1956	...	226,270	275,982	180,970	7,007,849	5,524,437	4,839,206
1957	...	229,667	381,785	164,477	7,660,605	6,406,589	6,493,170
1958	...	245,931	360,930	163,480	8,506,978	7,374,603	6,937,866
1959	...	395,446	387,634	175,075	8,775,277	7,515,804	7,489,900
1960	...	283,930	400,619	176,947	7,641,478	12,950,894	6,817,536
1961	...	291,665	437,046	177,869	9,334,897	8,475,598	7,585,460

It appears from Table 10-5 that there has been a steady rise in the number of patients treated both indoor and out-door, the exception being the year 1960. In 1961, the men, women and children who received treatment as in-patients constituted 1.7%, 2.6% and 2.2% of the adult male, adult female and child population of the State respectively. The corresponding percentages for out-door patients are 55.2, 50.5 and 52.9 respectively. Table 10-6 gives the average daily attendance of men, women and children for the years 1956 to 1961.

TABLE 10–6

Average daily attendance of out-patients

Year		Men	Women	Children
1956	...	48,809	42,728	34,033
1957	...	40,656	36,571	28,700
1958	...	50,660	43,831	39,037
1959	...	55,607	58,678	43,925
1960	...	55,071	56,595	47,182
1961	...	54,874	49,796	41,108

The average daily attendance of out-door patients has also steadily increased during this period. The ratio of average number of in-patients per day to average daily attendance in 1961 works out to 0.19 for men and 0.21 for women.

Perhaps the most important information available from this report is the data on the number of persons treated for different diseases. In fact this is the only information available on morbidity in Madras State. The number of patients treated for some of the major diseases are given in Table 10-7.

A complete picture of the different ailments treated in the State is given in Table 10-8. It appears from this table that the number of patients has increased considerably in respect of most of the ailments which probably reflects the expansion of medical facilities that has taken place in the State. The ailments having the largest number of out-patients treated, together with the in-patients and the percentage of in-patients to out-patients in 1961 are given in Table 10-7. Digestive diseases, injury and scabies contribute to the largest number of out-patients in the hospitals of Madras State

TABLE 10–7

Major ailments treated in hospitals, 1961

Ailments	Out-patients	In-patients	Index of hospitalisation
			Percentage
1. Other digestive diseases ...	1,659,829	28,321	1.7
2. Superficial Injury ...	1,363,522	13,594	1.0
3. Scabies ...	1,231,268	6,474	0.5
4. Otitis Media and Mastoidites ...	1,019,218	2,380	0.2
5. Avitomiosis and deficiency states ...	957,299	21,118	2.2
6. Infections ...	930,800	12,563	1.3
7. Acute Bronchitis ...	898,953	13,327	1.5
8. Wounds ...	868,948	13,425	1.5
9. Inflammatory diseases of the eye ...	800,384	6,741	0.8
10. Anaemia ...	779,069	31,076	4.0
11. Upper respiratory infections ...	744,041	12,620	1.7
12. Influenza ...	704,225	20,893	3.0
13. Rheumatism, muscular and others ...	663,471	7,491	1.1
14. Teeth and gum diseases ...	658,587	2,188	0.3
15. Other parasitic and infectious diseases ...	574,385	13,675	2.4
16. Bronchitis, chronic and others ...	515,822	11,037	2.1
17. Female genital organs ...	488,498	42,968	8.8
18. Gastro entiritis and calitis.	476,936	19,603	4.1
19. Others ...	387,674	9,490	2.4
20. Bacillary dysentery ...	355,612	6,752	1.9

with more than a million patients in each category. Infections, acute bronchitis, inflammatory diseases of the eye, anaemia, upper respiratory infections, influenza, rheumatism, teeth and gum diseases and other parasitic and infectious diseases come next with over 5 lakh patients.

TABLE 10–8

Number of in and out-patients treated for different diseases in Madras State, 1956-61

Name of Disease	1956		1957		1958		1959		1960		1961	
	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP
Tuberculosis :												
1. Respiratory ...	17,030	139,769	24,098	809,728	21,876	122,145	21,433	145,613	23,359	108,383	22,797	174,067
2. Meningeal and Central nervous ...	1,086	1,087	862	2,090	1,038	2,332	1,376	2,714	1,518	2,367	1,942	2,475
3. Intestines Peritoneum & Mesentric Glands ...	1,371	6,484	1,631	5,633	1,985	6,854	1,954	7,316	1,811	7,194	1,993	6,160
4. Bones & Joints ...	1,508	11,877	2,194	16,455	2,665	10,193	1,702	10,291	1,802	12,762	2,000	16,552
5. Others ...	2,556	25,551	2,861	42,816	4,775	30,754	4,974	28,777	4,118	28,265	5,283	43,242
Syphilis :												
6. Congenital ...	584	14,208	790	10,203	847	7,379	604	9,029	524	6,659	641	7,383
7. Early ...	1,419	35,180	1,862	40,475	1,539	38,772	1,492	42,208	1,052	36,360	1,212	31,280
8. Tabes Dorsalies ...	36	582	328	390	54	643	62	189	62	327	31	443
9. General Paralysis ...	693	1,480	601	5,183	156	1,982	425	1,501	279	2,399	812	4,659
10. Others ...	2,675	52,871	2,697	56,682	3,077	53,424	2,305	53,697	3,559	53,614	1,801	77,350
11. Gonococole Infection ...	2,633	165,822	3,511	110,767	2,799	94,599	1,643	95,900	1,481	78,711	2,135	85,673
12. Typhoid ...	9,144	21,667	10,717	25,841	13,654	30,384	13,031	21,384	13,557	21,212	21,052	27,174
13. Para-Typhoid ...	617	6,916	715	8,483	701	7,079	984	7,134	808	5,003	1,262	15,479
14. Cholera ...	65	592	1,266	1,038	1,236	1,162	332	2,053	60	311	97	403
15. Undulant Fever ...	328	15,600	3,594	24,401	1,204	50,699	1,067	37,101	2,293	94,554	15,353	34,725

TABLE 10-8—(Contd.)

Number of in and out-patients treated for different diseases in Madras State, 1956-61—(Contd.)

Name of Disease	1956		1957		1958		1959		1960		1961	
	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP
Dysentery :												
16. Amoebic ...	6,160	205,970	9,574	40,831	6,702	228,661	5,684	238,328	5,060	220,574	7,405	246,325
17. Bacillary ...	9,301	194,333	10,944	331,220	8,003	322,207	5,801	372,832	6,181	318,257	6,752	355,612
18. Others ...	3,208	176,326	6,629	252,444	5,098	304,684	4,379	286,039	6,401	302,750	8,889	332,594
19. Scarlet Fever ...	1	109	4	703	52	46	13	3,426	6	107	1	469
20. Streptococcal Throat ...	1,362	48,559	1,931	53,506	2,322	57,377	1,380	61,506	978	55,545	1,061	67,368
21. Erycepelas ...	186	1,237	164	1,483	33	953	34	741	68	2,995	100	1,492
22. Seplicaemia & Pyaemia ...	1,765	30,531	1,256	27,577	1,058	38,829	835	16,923	783	13,501	812	14,583
23. Diphtheria ...	1,927	2,676	1,859	3,056	1,789	3,803	1,870	4,370	2,568	3,689	361	7,108
24. Whooping Cough ...	932	48,966	922	58,283	1,037	68,082	778	67,669	1,412	70,070	1,237	70,679
25. Meningococcal Infections ...	511	1,132	377	1,897	2,954	825	465	1,510	291	689	348	1,987
26. Plague ...	2	341	2	346	2	58	8	29	...	5	191	...
27. Leprosy ...	4,216	143,910	17,720	134,135	3,521	105,018	6,757	101,493	5,255	126,845	6,876	155,598
28. Tetanus ...	2,881	3,998	2,738	3,626	3,509	5,254	3,772	4,848	4,211	4,819	5,133	6,744
29. Anthrax ...	5	40	4	27	3	49	13	1,310	1	1,280	1	31
30. Poliomyelitis Acute ...	183	824	342	1,358	248	1,303	478	2,908	455	1,323	687	2,587
31. Encephalities Acute Infections ...	286	309	1,080	175	1,159	319	354	622	377	334	641	715
32. Late effects of 30 and 31 ...	177	931	155	991	164	1,435	184	1,633	144	1,226	233	2,786
33. Small-pox ...	530	704	1,707	582	6,704	1,004	3,206	1,298	759	630	723	674

34. Measles ...	524	7,833	701	4,202	1,317	4,821	1,572	5,125	664	5,317	807	5,286
35. Yellow Fever ...	...	...	72	15,862	58	3,632	2,165	1,860	312	248	114	88
36. Hepalitis Infections ...	3,447	26,855	3,737	29,928	3,497	34,254	3,215	29,105	7,064	26,145	4,855	46,407
37. Rabies ...	840	4,794	288	4,151	299	4,668	347	5,552	256	3,639	286	4,300
38. Typhus and other Ricket Diseases ...	95	3,011	29	658	358	746	28	2,566	99	917	52	1,355
39. Malaria ...	12,642	453,462	10,321	436,534	850	343,305	6,014	247,920	5,268	196,264	4,288	93,049
40. Schistosomciasis ...	22	53	5	100	4	44	33	445	776	16	68	92
41. Hydatid disease ...	44	14,290	600	108	1,064	112	143	100	135	630	127	28
42. Filarresis ...	3,379	118,280	2,508	107,588	2,539	99,574	2,530	93,782	2,516	278,330	3,041	107,748
43. Ankylostimiasis ...	3,017	83,941	3,110	63,985	4,206	88,783	2,786	69,681	3,352	76,566	4,090	211,828
44. Other diseases due to Helmirittis.	2,913	209,246	2,413	135,119	3,840	185,069	3,118	181,318	2,619	174,796	3,160	192,055
45. Kala Azar ...	835	2,108	680	2,877	615	3,059	459	3,667	543	1,772	532	2,841
46. Guinea worm Infection ...	255	5,656	151	4,872	150	4,119	93	3,839	105	3,598	138	3,961
47. Relapsing Fever ...	133	8,046	208	7,755	290	2,020	237	17,523	70	18,387	417	12,550
48. Other Parasitic and Infectious diseases ...	10,559	447,829	7,722	486,504	9,121	622,811	9,593	650,464	10,915	1,562,171	13,675	574,385
Malignant Neoplasm :												
49. Bucal cavity and Pharyax ...	485	3,580	709	2,755	1,401	3,382	319	14,371	721	7,648	846	5,056
50. Esophagus ...	157	331	285	262	230	337	212	484	191	228	339	1,074
51. Stomach ...	595	7,014	860	4,669	594	3,312	692	4,092	623	2,814	87	2,145
52. Intestines ...	273	4,916	382	2,344	241	1,699	245	2,895	318	500	286	2,780
53. Rectum ...	429	812	299	628	283	765	299	723	581	707	540	808
54. Larynx ...	238	390	643	327	923	481	172	696	298	508	480	788
55. Trachea, Bronchus and Lungs ...	276	537	119	1,020	200	724	262	6,161	200	1,129	200	3,052

TABLE 10-8—(*Contd.*)

Number of in and out-patients treated for different diseases in Madras State, 1956-61—(*Contd.*)

Name of Disease	1956		1957		1958		1959		1960		1961	
	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP
56. Breast ...	560	1,835	446	2,123	1,527	3,485	619	2,165	585	2,154	681	2,909
57. Curirx, Uteri ...	1,401	2,709	1,542	2,739	1,763	3,277	1,740	4,608	808	3,449	866	2,971
58. Other parts of Uterus ...	501	1,466	302	1,735	399	1,792	507	1,644	496	1,440	442	887
59. Prostate ...	193	151	181	169	176	199	108	227	106	133	114	302
60. Skin ...	656	25,901	681	4,970	1,302	43,260	769	139,173	559	176,450	466	7,140
61. Bone and Connective Tissues ...	641	6,636	430	2,757	627	5,794	475	3,134	458	2,225	450	2,657
62. Other Sites ...	1,127	6,548	933	5,579	1,298	7,352	1,799	4,315	1,425	7,147	1,878	9,045
63. Leukemia and Aleukemia ...	236	3,416	188	1,295	1,000	1,024	254	609	122	483	307	1,697
64. Lympho sarcoma and other lymphail and Hematopoietic Neoplasms ...	913	8,554	807	8,864	848	9,219	819	9,437	313	1,548	709	10,383
65. Benign and other Neoplasms ...	1,632	12,444	1,603	14,528	2,158	11,508	2,111	10,912	1,765	11,184	2,018	9,343
66. Non-Toxic Goitre ...	142	1,796	316	3,637	349	2,466	278	582	319	1,322	208	827
67. Thyroxicosis ...	308	732	324	2,114	274	965	243	804	262	738	283	877
68. Diabetes Mellitus ...	1,891	25,017	2,098	28,300	2,834	30,986	2,456	34,641	2,137	28,692	3,260	40,948
69. Beriberi ...	176	8,207	254	19,765	292	23,528	194	13,168	323	11,286	221	20,693
70. Pellagra ...	48	7,210	617	5,382	36	5,637	38	6,715	33	3,297	42	2,851
71. Scurvy ...	68	8,891	319	14,659	180	11,472	275	20,467	178	5,479	99	5,903
72. Rickets ...	362	23,529	1,073	24,107	234	27,874	284	30,978	371	19,757	264	19,401
73. Ostea shelacia ...	332	6,134	927	4,483	1,067	4,271	291	4,731	426	9,989	363	6,611
74. Gout ...	238	1,663	61	2,604	32	3,503	31	4,546	26	2,766	243	858

75. Aritomiasis and Deficiency States ...	13,126	411,453	14,628	469,859	15,319	572,023	23,795	764,048	16,961	698,540	21,118	957,299
76. Anaemia ...	23,902	573,029	23,468	550,752	28,968	702,459	25,488	646,996	23,342	788,754	31,076	779,069
77. Asthma ...	6,856	260,957	7,225	301,092	7,631	411,428	8,166	341,417	7,553	28,486	9,255	272,101
78. Allergic disorders, Metabolic and Blood diseases ...	2,220	17,658	1,520	100,582	1,242	104,715	1,407	109,587	2,429	100,194	2,686	166,108
79. Psychosis ...	230	2,009	562	2,212	614	2,880	611	3,362	535	2,320	573	2,479
80. Psychoneurosis ...	218	1,888	429	1,941	398	2,367	547	3,099	643	2,852	486	3,458
81. Mental Deficiency ...	327	1,590	253	1,484	373	1,929	307	2,799	316	10,859	268	2,982
Diseases of Central Nervous System and Sense Organs :												
82. Vascular lesious ...	1,054	9,119	1,113	4,378	1,154	6,318	967	5,442	1,591	7,400	1,460	8,548
83. Non-Meningscoccal Meningitis...	525	1,187	496	1,434	683	1,073	444	414	579	3,028	430	1,836
84. Disseminated scelerosis ...	67	220	227	687	95	192	64	165	77	78	34	72
85. Epilepsy ...	1,005	5,367	981	5,999	917	11,360	1,244	12,475	1,336	6,685	1,691	8,037
86. Trachoma ...	350	14,481	411	10,523	1,821	15,624	361	20,143	163	13,692	173	13,583
87. Inflammatory diseases of the Eye	6,633	788,202	8,006	904,106	6,400	924,423	6,621	1,043,656	7,950	847,287	6,741	800,384
88. Cataract ...	8,275	32,767	15,064	54,881	12,561	48,500	18,005	94,338	15,843	88,227	17,382	60,524
89. Glaucoma ...	1,116	6,948	1,563	6,733	1,535	10,804	1,870	17,238	1,500	15,350	1,773	13,510
90. Otitis media and Mastoiditis ...	2,167	639,991	2,434	868,988	3,959	808,253	3,173	882,058	2,379	781,231	2,380	1,019,218
91. Others ...	4,213	306,968	6,756	342,238	5,309	374,842	6,124	648,618	7,131	363,484	9,490	387,674
92. Rheumatic Fever ...	2,466	66,551	2,476	145,073	2,431	105,349	2,380	99,174	2,181	30,338	2,687	86,987
93. Chronic Rheumatic Heart Diseases ...	1,682	10,464	2,840	10,819	2,979	13,670	2,524	11,575	1,604	12,135	3,657	11,067
94. Arterio Scelerotic and degenerative heart diseases ...	471	4,307	480	5,745	1,096	2,365	987	4,175	1,329	2,834	1,388	4,798

TABLE 10-8—(*Contd.*)

Number of in and out-patients treated for different diseases in Madras State, 1956-61—(*Contd.*)

Name of Disease	1956		1957		1958		1959		1960		1961	
	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP
95. Other heart diseases ...	4,875	26,717	5,518	35,790	5,221	33,514	5,578	31,981	5,718	31,304	6,867	43,963
96. Hypertension with heart disease.	1,403	9,555	1,174	11,489	1,743	9,457	2,293	11,235	2,602	15,742	2,839	16,385
97. Hypertension without heart disease ...	1,509	9,317	2,648	11,537	1,831	14,027	2,338	14,914	3,003	16,657	3,644	21,755
98. Diseases of arteries ...	797	8,644	600	8,786	919	8,021	685	8,531	714	4,481	817	6,208
99. Other circulatory ...	4,005	61,366	1,850	57,348	3,155	69,032	2,659	84,386	2,508	122,837	3,145	111,119
100. Upper respiratory infections ...	5,817	415,878	4,909	522,266	7,475	732,363	8,056	846,323	8,922	792,398	12,620	744,041
101. Influenza ...	14,764	718,643	24,780	1,094,623	15,390	720,975	14,996	735,565	14,616	43,738	20,893	704,225
102. Lober Pneumonia ...	5,190	34,777	7,313	147,672	5,617	36,665	4,803	29,140	4,103	21,834	8,793	28,589
103. Broncho Pneumonia ...	7,398	120,557	9,396	94,158	9,937	129,254	9,543	116,924	8,702	112,014	9,439	123,305
104. Primary atypical and other Pneumonia ...	1,857	9,709	3,611	25,300	1,673	12,295	1,601	15,795	2,343	33,245	1,092	17,610
105. Acute Bronchitis ...	9,903	767,686	10,943	833,902	12,310	1,076,306	10,717	910,340	9,522	822,903	13,327	898,953
106. Bronchitis Chronic and others ...	8,726	357,646	6,864	450,865	7,850	520,947	8,623	579,569	9,198	525,122	11,037	515,822
107. Hypertrophy of tonsils and adenoids ...	6,351	98,804	5,974	110,423	4,979	170,595	5,862	226,396	4,475	172,371	5,175	146,501
108. Empyema and abscess of lung ...	728	1,983	1,531	5,285	1,381	1,471	962	2,294	722	2,070	668	2,412
109. Pleurosy ...	2,042	16,833	2,210	18,595	2,386	17,448	2,371	19,644	2,167	22,475	2,358	21,864
110. Other respiratory ...	4,982	286,370	3,022	322,857	4,412	374,473	4,254	429,210	4,593	310,450	5,570	349,842
111. Teeth and Gum diseases ...	2,034	539,590	8,415	7,005,630	1,487	689,186	1,662	742,805	1,820	647,425	2,188	658,587
112. Stomach Ulcer ...	5,157	60,874	3,819	56,391	3,825	62,775	6,165	68,333	8,740	80,298	5,642	109,997

113. Duodenal Ulcer ...	6,063	23,364	4,069	33,978	4,831	33,770	4,454	36,252	5,183	65,119	4,815	31,954
114. Gastiritis and Duodinitis ...	5,068	264,098	4,922	324,317	5,535	338,593	5,959	376,481	6,057	359,350	7,364	347,033
115. Appendicitis ...	2,358	4,702	2,558	4,811	3,160	5,824	2,954	4,981	2,552	5,376	2,970	7,128
116. Hernia ...	4,644	7,879	5,177	8,551	6,321	8,794	6,215	9,571	5,726	10,406	6,968	11,899
117. Intestinal Obstruction ...	1,751	4,831	1,829	4,289	1,957	3,135	2,054	10,580	2,071	46,565	2,388	8,826
118. Gastro Entiritis and Colities ...	14,455	414,669	12,557	441,511	17,188	502,621	14,867	495,734	12,441	548,657	19,603	476,936
119. Chronic enteritis and Ulcerative colities ...	5,478	221,887	5,397	193,179	5,127	229,596	6,204	179,385	5,546	143,891	6,077	196,830
120. Cirrhosis of Liver ...	3,222	18,840	3,633	16,932	4,122	22,570	4,363	21,101	3,471	16,360	4,415	18,402
121. Choleolthiosis and Cholecystitis	520	5,636	315	4,237	522	2,312	465	2,939	339	5,149	307	2,783
122. Other digestive Diseases ...	23,614	1,209,858	23,429	1,186,122	24,082	1,488,158	20,518	2,109,404	21,456	1,447,822	28,321	1,659,829
Diseases of Genito Urinary System :												
123. Acute Nephritis ...	3,766	34,166	4,131	41,548	4,572	48,031	4,592	37,972	3,587	34,982	4,793	59,327
124. Nephritis chronic and others ...	1,737	14,091	3,018	23,618	2,482	24,330	1,713	19,079	1,792	20,480	2,739	20,556
125. Kidney infections ...	1,737	14,091	1,541	13,449	2,505	16,115	1,560	10,830	1,120	12,289	1,307	16,143
126. Urinary Calculil ...	590	9,792	818	13,435	607	11,081	1,161	9,090	718	9,219	880	7,595
127. Prostate Hyperpiasia ...	341	1,389	644	2,269	535	1,665	735	2,037	566	1,914	456	1,132
128. Breast diseases ...	2,226	18,137	8,936	23,924	1,813	21,887	6,210	18,478	7,625	21,143	1,352	23,351
129. Male genital organs ...	10,066	138,026	7,803	167,926	10,649	225,871	10,912	161,851	13,877	135,232	11,248	264,266
130. Female genital organs ...	25,121	290,405	33,756	337,730	28,514	402,021	24,550	410,340	19,829	363,486	42,968	488,498
131. Others ...	5,789	89,615	11,281	116,117	8,819	115,164	10,652	137,498	5,453	121,487	6,808	113,481
Deliveries and diseases of Pregnancy, child birth and Puerperium :												
132. Sepsis ...	3,265	18,807	4,527	33,921	4,569	32,010	3,846	28,826	4,936	34,999	5,404	34,864
133. Toxaemia ...	22,732	16,931	4,685	10,801	5,142	11,887	7,359	20,775	5,095	23,699	6,653	20,160

TABLE 10-8—(Contd.)

Number of in and out-patients treated for different diseases in Madras State, 1956-61—(Contd.)

Name of Disease	1956		1957		1958		1959		1960		1961	
	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP	IP	OP
134. Haemorrhage ...	2,267	5,566	6,072	10,131	4,504	7,319	3,714	8,984	4,169	11,863	3,181	11,120
135. Abortion without sepsis or toxaemia ...	11,418	30,417	14,156	38,065	15,787	55,974	17,022	37,509	19,653	36,432	16,810	38,821
136 Abortion with sepsis ...	6,279	9,919	4,326	16,468	5,770	16,291	5,253	17,076	6,260	12,835	6,921	17,399
137. Normal deliveries ...	64,252	48,860	99,730	65,232	108,685	84,748	129,301	94,703	115,053	69,368	122,048	87,169
138. Other complications ...	28,200	50,249	40,355	72,178	39,697	124,065	30,332	96,714	27,036	93,921	23,529	88,633
Diseases of skin & musculoskeletal system :												
139. Scabies ...	7,518	748,261	6,317	938,859	9,562	1,104,309	7,782	948,231	6,757	834,057	6,474	1,231,268
140. Infections ...	10,132	725,521	11,336	616,257	15,214	984,623	15,064	865,669	11,189	783,752	12,563	930,800
141. Anthritis and spondylitis ...	3,742	128,627	5,560	141,979	6,006	179,569	5,574	155,934	5,901	174,687	4,798	170,194
142. Rheumatism, Muscular and others ...	5,662	410,788	5,586	492,402	7,488	565,180	6,371	653,664	7,036	578,379	7,491	663,471
143. Osteomyelitis and Perioslitis ...	1,839	10,679	1,807	12,168	1,430	10,396	1,786	15,711	2,404	16,732	1,975	17,812
144. Ankylosis and acquired deformities ...	670	5,861	759	6,062	574	9,242	349	9,441	462	9,087	619	8,582
145. Others ...	5,335	312,036	4,398	325,293	6,002	380,829	6,435	334,869	7,899	304,981	7,080	276,695
Congénital Malformation :												
146. Spinafida and meningocele ...	3,128	1,818	487	437	152	480	4,148	3,882	242	1,951	1,508	1,079
147. Circulatory Systems ...	901	2,230	1,392	6,625	265	7,051	523	5,825	668	6,953	478	17,802
148. Others ...	633	8,168	758	17,470	771	18,264	1,424	9,284	1,131	5,954	618	8,116

Diseases of early infancy :												
149. Birth Injury ...	648	240	3,323	870	1,140	1,149	3,067	378	4,383	1,067	4,404	2,131
150. Post-natal Asphyxia and Atsactasiasis ...	529	472	671	524	603	1,303	1,779	721	1,511	2,570	2,107	18,185
151. Infections of the new born ...	10,568	5,464	14,966	4,850	7,171	4,074	7,154	4,852	4,714	4,555	5,190	4,267
152. Hemolytic diseases of new born...	352	1,736	682	1,012	1,272	265	1,058	279	1,115	378	987	4,036
153. Others ...	11,901	8,065	23,839	12,212	27,814	9,848	25,196	5,745	29,221	7,391	24,676	6,669
154. Ill-defined conditions ...	2,174	9,849	1,249	3,761	1,537	3,556	703	1,095	679	3,862	1,270	3,619
155. Senility ...	440	3,983	894	2,893	1,132	5,270	235	2,039	412	3,812	7,402	1,578
156. Ill-defined conditions ...	1,544	81,077	3,444	64,900	2,680	73,582	3,251	77,998	2,907	59,071	3,674	42,402
Accidents, Poisoning and Violence :												
157. Fracture of skull ...	414	517	398	579	462	1,525	391	1,642	418	1,955	346	533
158. Fracture of spine and trunk ...	765	4,030	774	3,218	819	2,029	747	2,223	1,350	2,780	858	3,237
159. Fracture of limbs ...	6,238	23,215	5,116	28,456	5,534	40,704	5,046	33,178	5,719	33,386	6,734	32,240
160. Dislocations ...	1,082	19,824	1,186	17,730	993	17,873	880	16,073	1,248	16,908	1,063	18,351
161. Sprains and Strains ...	1,653	148,751	1,243	222,816	1,003	201,060	1,213	166,261	1,507	133,191	1,367	134,173
162. Head Injury ...	2,053	21,630	2,751	70,323	2,037	52,862	1,889	32,492	3,076	29,543	2,203	21,959
163. Internal Injury ...	1,074	2,617	961	6,571	1,029	6,382	1,183	78,840	1,044	2,796	1,080	7,691
164. Wounds ...	14,515	770,741	10,299	751,550	12,203	1,095,764	12,882	1,117,741	12,076	786,802	13,425	868,948
165. Superficial Injury ...	11,323	635,884	10,088	671,585	10,846	919,353	12,165	856,959	12,379	688,508	13,594	1,363,522
166. Foreign Body effects ...	1,875	46,919	1,170	58,080	1,087	63,347	1,317	79,722	1,256	69,060	1,320	73,997
167. Burns ...	2,507	31,129	2,995	38,513	2,915	43,950	2,945	36,942	3,339	33,292	3,786	33,433
168. Poisoning ...	2,330	11,852	2,101	11,465	2,712	18,135	3,360	16,776	3,753	15,036	4,878	16,798
169. Others ...	3,804	126,474	4,139	145,541	5,068	154,429	13,294	231,507	7,052	170,205	6,453	203,421
Grand Total ...	666,710	16,891,292	799,942	26,015,666	798,592	21,819,250	811,649	22,975,944	773,940	20,250,452	892,812	22,574,452

Table 10-9 gives the number of surgical operations performed during the period 1956 to 1961 and the fatality rate.

TABLE 10-9

Surgical operations, 1956-61

Year	No. of surgical operations	No. of deaths	Fatality rate: Among surgical operations	Fatality rate: Among in-patients
1	2	3	4	5
1956 ...	82,819	209	0.25	0.04
1957 ...	529,509	1,011	0.19	0.17
1958 ...	607,084	1,206	0.20	0.20
1959 ...	549,705	1,223	0.22	0.16
1960 ...	364,200	798	0.22	0.12
1961 ...	464,674	1,570	0.34	0.22

The fatality rate for all in-patients admitted to the hospitals is given in Col. 5. It appears that the fatality rate for surgical operations is 0.34% of the operations and 0.22% among the number of in-patients in 1961. There is considerable fluctuation in the fatality rate from year to year.

Statistical organisation in the hospital

It is worth recalling here the returns maintained by the hospitals. The principal documents are:

In-patients

(1) Admission notice.

(2) Ward return

(3) Admission and discharge register (or equivalent).

(4) Discharge Card (for statistical analysis)

Out-patients

(1) Admission register.

(2) Clinic return.

The admission notice gives such details as name, hospital registration number, home address, sex, age, occupation, next of kin, name of physician or surgeon under whose care the patient is admitted, etc. The ward returns are usually filled up at some fixed hour of the day (usually the mid-night, because this is the time when movement is minimal and conditions are quiet.) A standard form is used which shows the number of admissions to and discharges from the ward during the previous 24 hours. The form must reconcile with other data such as admissions and discharges shown in the admission and discharge register.

The admission and discharge register provides information on the speciality, diagnosis, duration of stay in hospital, etc., and each individual movement is listed with appropriate code numbers. The discharge card carries the usual registration, details such as age, sex, diseases treated and details regarding diagnosis. The out-patients admission register enables the separation of new patients from old and also checks non-attendance.

Suggested studies

The need for a proper compilation of hospital data and their utilisation need hardly be stressed. The existing machinery for compilation at the Directorate of Medical Services needs strengthening with adequate statistical personnel and each hospital should have its statistical personnel to look after the completion of the returns.

There are statistical comparisons which can be made between individual hospitals as for instance, a comparison of the age-sex pattern of patients treated for a particular disease or the duration of the treatment in two different hospitals might be quite revealing. Some of the differences might be accountable by differences in availability of surgical resources or in staff-bed ratios, and this is worth examining. Some sort of time and motion study can be attempted to find out the time taken by a patient right from his arrival till he completes his formalities of registration and admission.

Yet another field is the study of hospital discharges. In 1949, the General Register Office (U.K.) began the analysis of hospital discharge records and their conclusions are presented in the Supplement of the Hospital In-patient Statistics to the Registrar General's Statistical Review for 1949 and since then several such volumes have appeared. There is scope for application of sampling in such studies.

Age-sex distribution of in-patients in hospitals

In Table 10-10, the age-sex distribution of in-patients treated for various diseases in 1956 in Madras State are given in eight broad age groups together with their percentages in each age-group.

AGE, SEX DISTRIBUTION OF IN-PATIENTS TREATED FOR VARIOUS DISEASES, 1956

TUBERCULOSIS

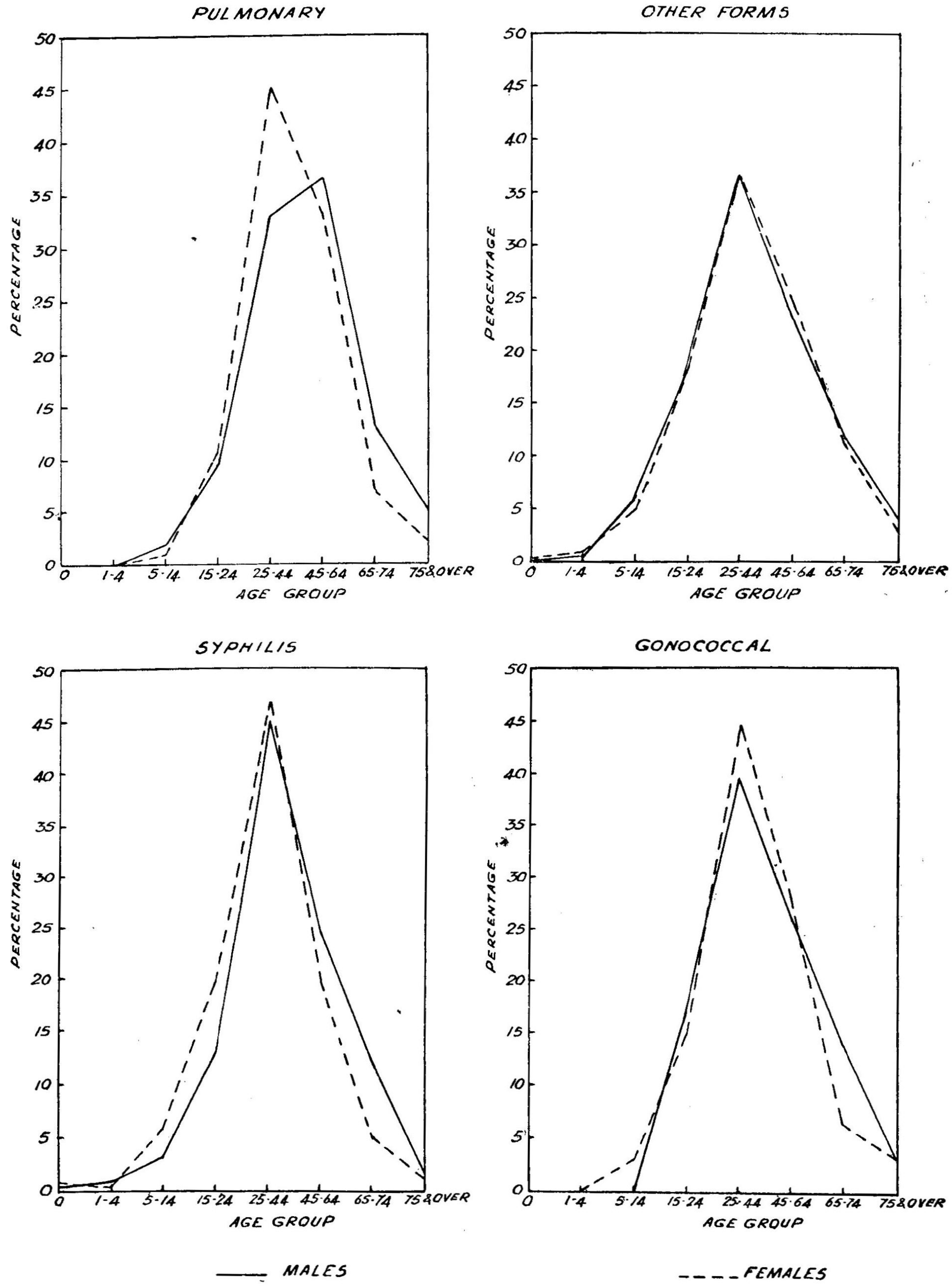


TABLE 10-10

Age-Sex Distribution of In-patients treated for various diseases, 1956

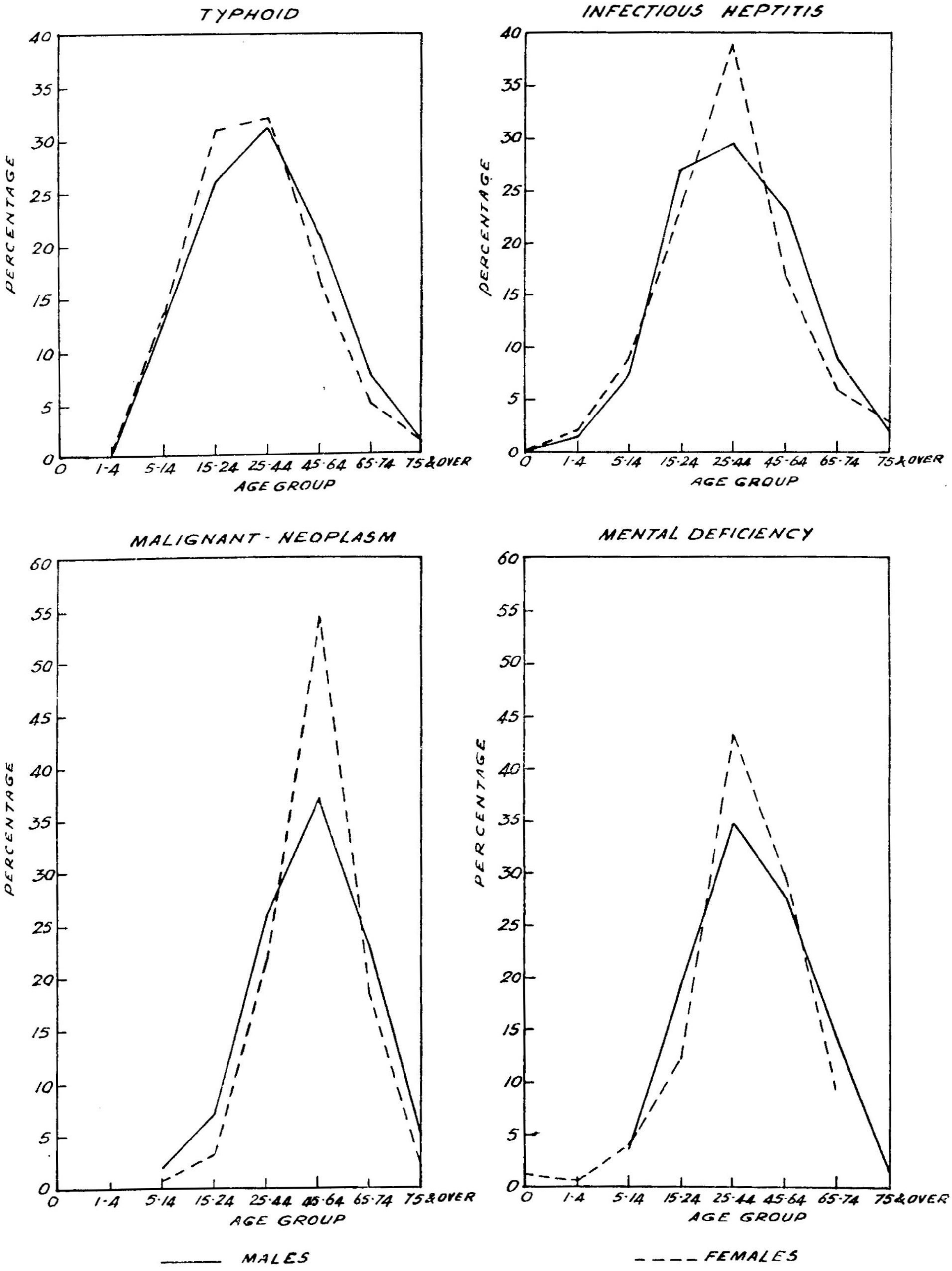
Age Group	Tuberculosis								Syphilis				Gonococole infections			
	Pulmonary				Other Forms											
	Males		Females		Males		Females		Males		Females		Males		Females	
	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
0 ...	1	0.02	6	0.12	3	0.12	8	0.48	8	0.46	10	0.78	1	0.12	...	...
1—4 ...	7	0.11	15	0.29	14	0.56	16	0.95	15	0.87	8	0.63	...	...	1	0.15
5—14 ...	142	2.15	68	1.33	160	6.36	86	5.11	51	2.96	73	5.72	3	0.36	21	3.08
15—24 ...	629	9.52	545	10.64	444	17.64	313	18.60	225	13.07	253	19.83	141	16.67	103	15.10
25—44 ...	2,184	33.04	2,319	45.28	918	36.47	614	36.48	769	44.69	597	46.79	334	39.48	304	44.57
45—64 ...	2,421	36.63	1,693	33.06	583	23.16	412	24.48	425	24.70	253	19.83	220	26.00	189	27.72
65—74 ...	881	13.33	368	7.19	292	11.60	184	10.93	202	11.74	65	5.09	121	14.30	44	6.45
75 & over ...	344	5.20	107	2.09	103	4.09	50	2.97	26	1.51	17	1.33	26	3.07	20	2.93
Total ...	6,609	100.00	5,121	100.00	2,517	100.00	1,683	100.00	1,721	100.00	1,276	100.00	846	100.00	682	100.00

TABLE 10-10—(*Contd.*)

Age-Sex Distribution of In-patients treated for various diseases, 1956—(*Contd.*)

Age Group	Typhoid				Infectious Heptitis				Malignant Neoplasm				Mental Deficiency			
	Males		Females		Males		Females		Males		Females		Males		Females	
	No.	Per-cen-rage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage
	(18)	(19)	(20)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)
0 ...	3	0.08	2	0.07	1	0.06	1	0.10	...	...	...	...	...	...	2	1.38
1—4 ...	18	0.45	16	0.57	24	1.51	24	2.32	...	...	...	...	...	...	1	0.69
5—14 ...	523	13.12	384	13.64	120	7.54	91	8.80	34	1.92	19	0.68	7	3.50	6	4.14
15—24 ...	1,033	25.92	868	30.82	429	26.95	252	24.37	127	7.18	79	2.82	38	19.00	18	12.41
25—44 ...	1,231	30.88	911	32.35	470	29.52	403	38.97	465	26.27	604	21.58	69	34.50	62	42.76
45—64 ...	839	21.05	466	16.55	372	23.37	175	16.92	649	36.66	1,523	54.41	55	27.50	43	29.66
65—74 ...	298	7.48	131	4.65	140	8.79	59	5.71	401	22.66	521	18.61	28	14.00	13	8.96
75 & over ...	41	1.02	38	1.35	36	2.26	29	2.81	94	5.31	53	1.90	3	1.50	...	...
Total ...	3,986	100.00	2,816	100.00	1,592	100.00	1,034	100.00	1,770	100.00	2,799	100.00	200	100.00	145	100.00

AGE, SEX DISTRIBUTION OF IN-PATIENTS TREATED FOR VARIOUS DISEASES, 1956



AGE, SEX DISTRIBUTION OF IN-PATIENTS TREATED FOR VARIOUS DISEASES, 1956

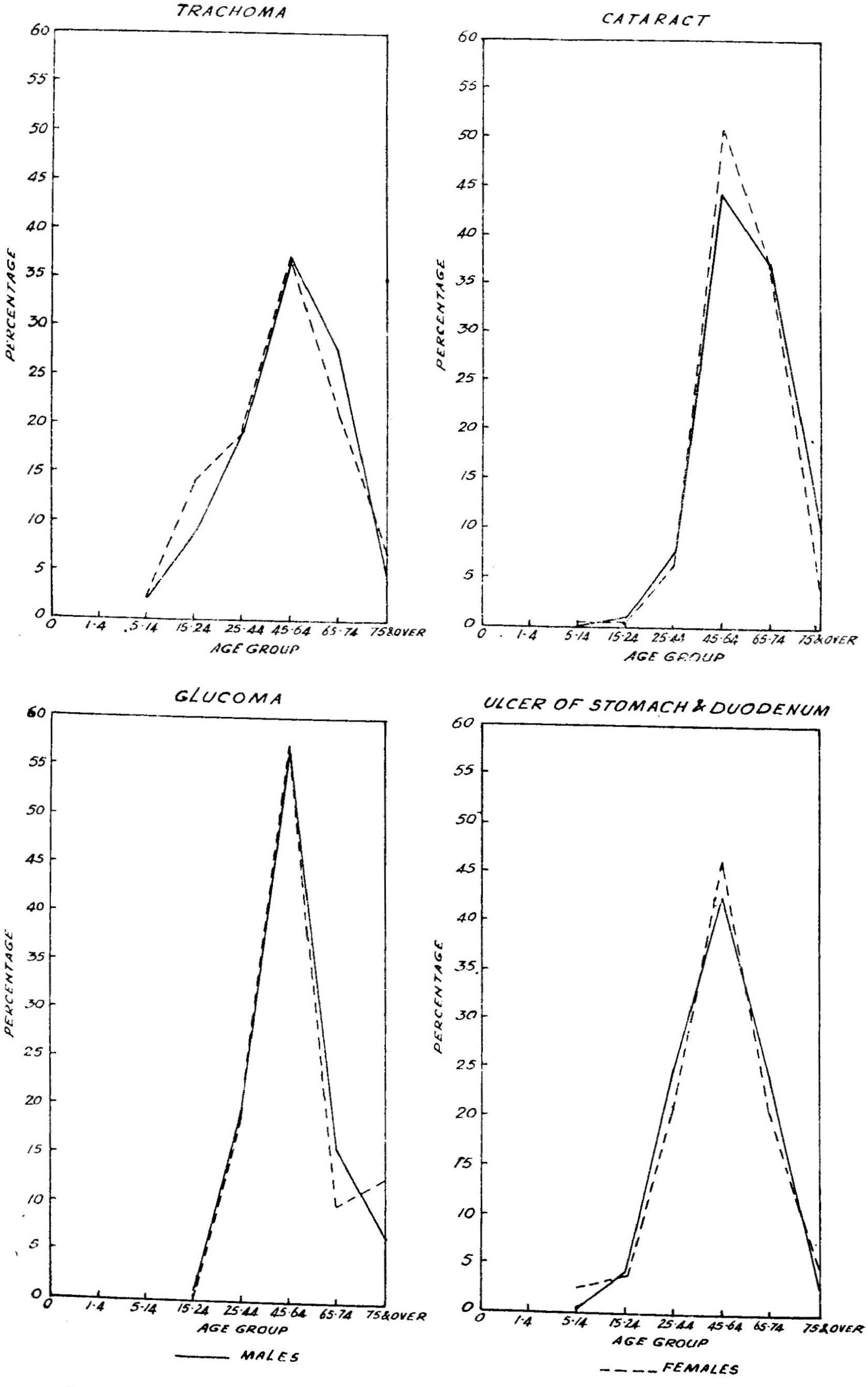


TABLE 10-10—(*Contd.*)

Age-Sex Distribution of In-patients treated for various diseases, 1956—(*Contd.*)

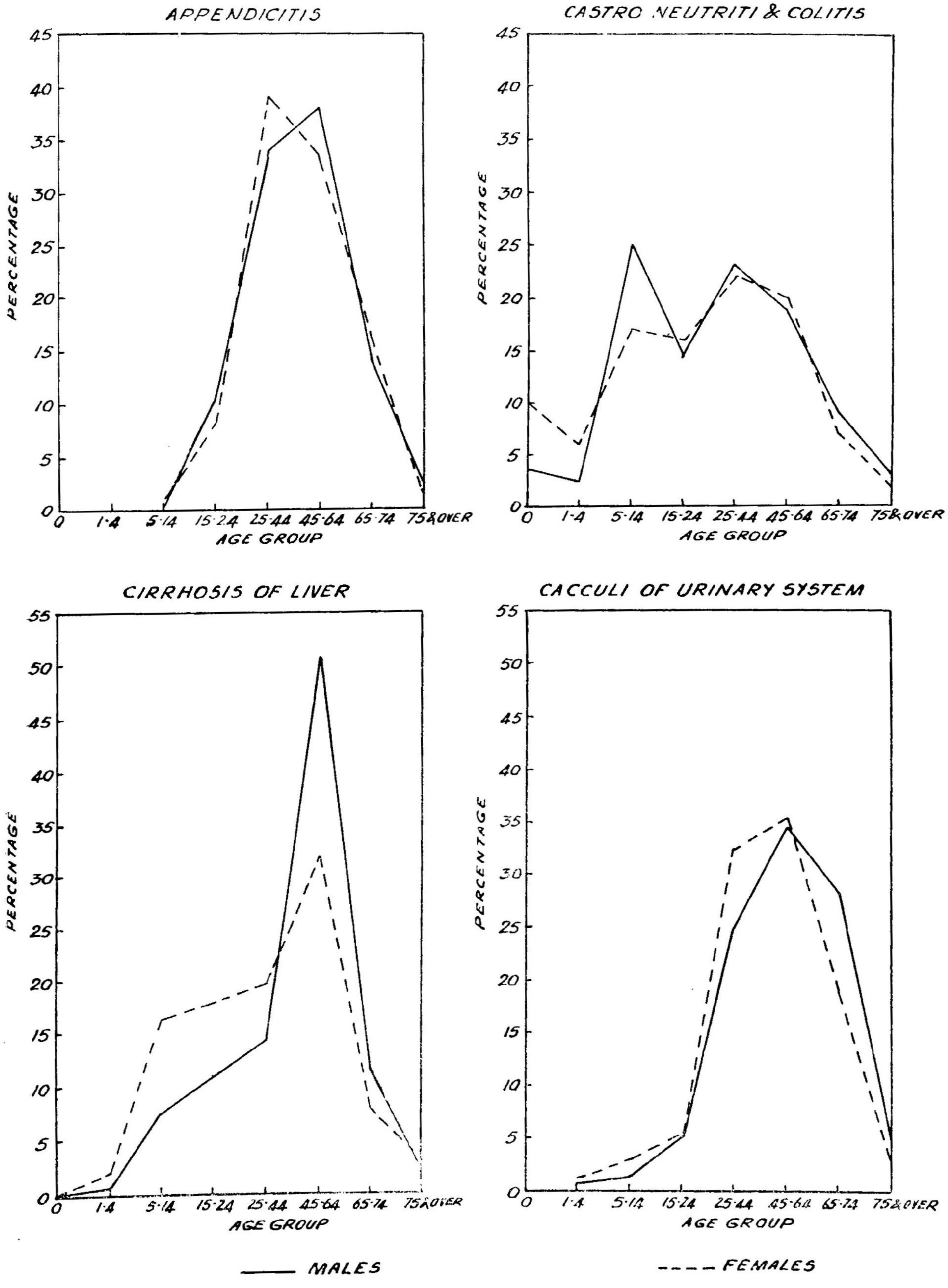
Age Group	Trachoma				Cataract				Glaucoma				Ulcer of Stomach and Duodenum			
	Males		Females		Males		Females		Males		Females		Males		Females	
	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage	No.	Percentage
	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	(47)	(48)	(49)
0 ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
1—4 ...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
5—14 ...	4	2.01	3	2.00	7	0.20	12	0.53	...	...	...	...	27	0.65	40	2.66
15—24 ...	18	9.05	21	14.00	26	0.75	14	0.62	4	0.77	2	0.52	180	4.32	58	3.86
25—44 ...	39	19.60	29	19.33	260	7.51	141	6.25	102	19.61	75	19.38	1,053	25.27	319	21.22
45—64 ...	74	37.18	56	37.33	1,544	44.59	1,151	51.02	294	56.54	220	56.85	1,774	42.57	694	46.18
65—74 ...	55	27.64	31	20.67	1,284	37.08	840	37.24	85	16.35	40	10.33	995	23.88	315	20.96
75 & over ...	9	4.52	10	6.67	342	9.87	98	4.34	35	6.73	50	12.92	138	3.31	77	5.12
Total ...	199	100.00	150	100.00	3,463	100.00	2,256	100.00	520	100.00	387	100.00	4,167	100.00	1,503	100.00

TABLE 10-10—(*Contd.*)

Age-Sex Distribution of In-patients treated for various diseases, 1956—(*Contd.*)

Age Group	Appendicitis				Gastro Neutritis and Colitis				Cirrhosis of Liver				Cacculi of Urinary System			
	Males		Females		Males		Females		Males		Females		Males		Females	
	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage	No.	Per-cen-tage
	(50)	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)	(59)	(60)	(61)	(62)	(63)	(64)	(65)
0 ...	...	...	...	...	143	3.51	266	9.88	1	0.07	2	0.31	...	...	...	...
1—4 ...	...	...	...	...	108	2.65	171	6.35	10	0.66	15	2.30	3	0.88	2	1.42
5—14 ...	6	0.45	5	1.06	1,027	25.21	452	16.79	115	7.64	107	16.44	5	1.48	4	2.84
15—24 ...	142	10.56	39	8.30	587	14.41	435	16.16	165	10.97	116	17.82	17	5.03	8	5.67
25—44 ...	455	33.83	184	39.15	941	23.10	591	21.95	221	14.68	129	19.82	83	24.56	46	32.62
45—64 ...	515	38.29	158	33.62	782	19.19	538	19.99	770	51.16	209	32.10	117	34.62	50	35.46
65—74 ...	191	14.20	77	16.38	366	8.98	186	6.91	182	12.09	52	7.99	96	28.40	27	19.15
75 & over ...	36	2.67	7	1.49	120	2.95	53	1.97	41	2.73	21	3.22	17	5.03	4	2.84
Total ...	1,345	100.00	470	100.00	4,074	100.00	2,692	100.00	1,505	100.00	651	100.00	338	100.00	141	100.00

AGE, SEX DISTRIBUTION OF IN-PATIENTS TREATED FOR VARIOUS DISEASES, 1956



In order to have a fairly good picture regarding the age group which is more exposed to the risk of these diseases, we should know the percentages of persons under each of these broad age groups to the total population which will facilitate a comparative analysis. The following table shows the number of males and females in each age group and their percentage to the total male and female population respectively.

TABLE 10-11

Distribution of Madras Population by Broad Age Groups, 1961

Age group	Males		Females	
	Number	Percentage	Number	Percentage
1	2	3	4	5
0 ...	573,600	3.39	581,500	3.47
1—4 ...	1,892,600	11.19	1,864,600	11.11
5—14 ...	3,812,400	22.54	3,813,700	22.74
15—24 ...	3,178,800	18.80	3,297,000	19.65
25—44 ...	4,660,300	27.56	4,585,400	27.33
45—64 ...	2,318,100	13.71	2,160,800	12.88
65—74 ...	390,000	2.31	383,400	2.29
75+ ...	85,200	0.50	89,600	0.53
Total	16,911,000	100.00	16,776,000	100.00

This table may be compared with the proportion of patients reporting at different age groups presented in Table 10-10. We find that the percentage of patients aged 25 and over is higher than the corresponding percentage in the population.

It is apparent that persons above 25 years are more exposed to the risk of these diseases than those below 25 years. In Tuberculosis, both pulmonary and other forms for example, the percentage of patients is high in the age groups 25-44 and 45-64. It is interesting to compare the percentage of Tuberculosis patients among males and females in the age group 25-44. Among males, 33.04% of patients admitted for pulmonary tuberculosis are in the age group 25-44 whereas among females the percentage works out to 45.28. If we remember that this age group represents the period where most women bear children, it is probable that the higher risk of exposure to pulmonary tuberculosis among women in this age group is strongly associated with pregnancy itself. From public health point of view, this may lead to serious hazards on the health of children born to such women.

Among all diseases, people of the age group 65-74 and 75 and over have been admitted as in-patients in large numbers as may be seen from the percentage of population of these age-groups. It is significant to note that female patients of the age group 25-44 exceed their male counterpart in all diseases, other than Malignant Neoplasm, Trachoma, Cataract, Glaucoma, Ulcer of stomach and Duodenum and Gastro Neutritis and Colitis. In the case of typhoid and infectious Heptitis we find that persons of the age group 5-14 and 15-24 are also afflicted in considerable numbers. In Malignant Neoplasm, the age groups 25-44, 45-64 and 65-74 are the worst affected; the high percentage of female patients in the age group 45-64 is noteworthy. We may also infer from the table that in respect of Trachoma, Cataract, Glaucoma, Ulcer, Cirrhosis of liver, and cacculi of urinary system, people between the ages 45-64 are very badly affected. In all these diseases as also in Appendicitis, Malignant Neoplasm or mental deficiency, children upto 4 years are not affected; or it may be that children afflicted with these diseases are not brought to hospitals. Among children upto the age of 14, the diseases recorded in large numbers are Gastro Neutritis and colitis, cirrhosis of liver and cacculi of urinary system. It is rather alarming to note that 4.29% of males and 7.13% of females suffering from syphilis are children below 14. In the case of Gonococcal infection, 3.23% of the females are children below 14. Considering the fact that the venereal diseases are carried through contacts, such high figures among children are due to a lack of realisation of the seriousness of this ailment among parents.

The data do not permit the drawal of any definite conclusions. Further, the figures cannot be taken in their face value as representing the incidence or affected persons in each disease as it merely portrays the number of people admitted in the different hospitals as in-patients in 1956. There may be cases not reported or treated privately. Albeit there are such serious limitations, the data provides us a clue from which empirical conclusions are drawn.

Employees' State Insurance statistics

The Statistics of the Employees' State Insurance Corporation are a valuable source of information concerning sickness in the working classes. The detailed statistics relating to medical benefits and sickness pattern compiled by the Employees' State Insurance Corporation are based on returns furnished primarily by the

dispensaries and panel practitioners. As the figures are furnished by the officers directly attached to the scheme, they may be deemed to be quite reliable except for the fact that it sometimes happens that some of the panel practitioners might not have furnished the returns. A major advantage with these statistics is that, unlike the statistical records of hospitals and dispensaries the population at risk is known and the incidence of various diseases can be estimated more reliably. The former statistics may be defective due to the poor and incomplete coverage of the population; but all persons insured under the scheme are entitled to take advantage of the facilities as they pay contributions for the benefit they get. Further, it has been laid down that a person who is in receipt of sickness benefit (cash) provided under the scheme shall remain under medical treatment at a dispensary, hospital, clinic or other institution.

While using the morbidity data collected on the basis of the operation of the Employees' State Insurance Scheme, the limitations of the 'frame' on which the statistics are based, have to be borne in mind. The scheme covers all employees drawing not more than Rs. 400 per month and employed in a factory using power and employing at least 20 persons; further, the scheme has not yet been implemented in all the areas.

The statistics can, therefore, be used only as a very broad indicator of the morbidity incidence in this country. It can be used for planning medical benefits for a given class of persons if the deviations that may be expected between the population covered by the scheme and that proposed to be covered can be estimated at least roughly. This statistics would also be of immense use to the State authorities to concentrate and channelise their efforts for eradicating such of those maladies as are comparatively more rampant in their States and also of those ailments which show an increasing trend. Further, as far as the Corporation is concerned, the data give the necessary information to take up appropriate preventive measures and also to plan their requirements of medicines depending upon the sickness mostly prevalent in the area.

The various appendices and tables on medical care and morbidity and the comments thereon found in the Annual Reports and Statistical Abstracts of the E.S.I. Corporation are also of value for studying generally the comparative trends of morbidity in the country and the standards of medical care provided by the Corporation.

The administrative statistics of the Employees' State Insurance Corporation for the years 1956-57 to 1961-62 reveal some interesting trends. The number of insured persons deemed exposed to risk has increased from 93,000 in 1956-57 to 204,150 in 1961-62, an increase of 119.5%. The number of new attendances had increased during the 5 years period by 171.1%. The attendance rate per 1,000 insured persons which stood at 308 for new patients in 1957-58 has increased to 3,492 in 1961-62. In respect of old cases, the increase has been from 990 in 1957-58 to 10,724 in 1961-62. These statistics clearly show a spectacular increase in the coverage of the Employees' State Insurance Corporation and also shows the expanding role of the Corporation in promoting the health and well-being of the workers.

Apart from benefiting the workers, the Corporation is extending similar benefits to the families of the workers. There were 22,000 family units in 1961-62. The following are the number of attendance by the family members of insured persons in 1961-62.

TABLE 10–12

Number of attendances by the family members of insured persons

	Attendance	No. of attendance per 1,000 family insured persons units
New ...	75,092	3,413
Old ...	222,304	10,105
Total ...	297,396	13,518

Similar figures for earlier years are not available. The number of family units is roughly 10% of the number of insured workers. If we compare the attendance rate for family units with that of the insured workers discussed earlier, we find that the rate is lesser for the family units.

Table 10–13 shows the number of new patients attended and the incidence of sickness per 1,000 insured persons under the Service System as well as the Panel System.

In the statistics presented here, an insured person taking treatment is treated as just one new case throughout the spell of sickness. At the end of the spell, he is certified by a doctor to be fit to resume work. If this insured person gets another spell of sickness after this certification and takes treatment available under the

TABLE 10-13

Incidence of sickness among insured persons

Year	Service system		Panel system	
	No. of new patients attended	Incidence per 1,000 insured persons	No. of new patients attended	Incidence per 1,000 insured persons
(1)	(2)	(3)	(4)	(5)
1956-57 ...	150,917	2,515	112,041	3,395
1957-58 ...	259,993	2,889	174,370	4,982
1958-59 ...	281,925	2,751	187,299	3,470
1959-60 ...	361,159	3,010	186,268	3,582
1960-61 ...	398,805	3,096	222,874	4,038
1961-62 ...	452,213	3,082	260,620	4,540

scheme, he is taken as a fresh case ignoring any linking of the two spells. There is a steady increase in the new attendances as well as the rate. This may be due to greater awareness and utilisation of the hospital facilities provided by the Employees' State Insurance and also due to an increase in the sickness rate. An analysis of the causewise statistics shows an increase in several categories, notably dysentery, acute pharyngitis, arthritis and rheumatism.

Under both the systems, the diseases of the eye, diseases of the stomach and duodenum, diarrhoea and entiritis, diseases of the genital organs, arthritis and rheumatism and other specific and ill-defined diseases have shown higher incidence as compared to the all-India experience. Under the Service System, other respiratory diseases showed a higher trend, whereas in the Panel System areas, Gonococcal infections, all other diseases classified as infective and parasitic, avitominosis and other deficiency states, diseases of veins, influenza, bronchitis, other diseases of digestive system, boil, abscess, cellulitis and other skin infections and other diseases of the skin, diseases of bones, other organs of movement and other specific and ill-defined diseases showed a higher rate than that of the all-India average.

Medical progress of Madras during 1951-61

Medical Education and Training Programmes in Madras State: It would be useful to analyse the progress in medical education and training programmes in Madras State during the planning era. The number of medical colleges in the State which was 2 in 1950-51 and 3 in 1955-56 has increased to 5 at the end of the Second Plan period. The number of people who are admitted in medical colleges has also gone up from 289 in 1950-51 to 550 in 1960-61. In the field of training also, there has been considerable improvement in the State since the beginning of planning. Training of doctors was taken up during the First Plan period. For the first time, training programmes for Dhais and Sanitary Inspectors were taken up under the Second Five-Year Plan. It is proposed to augment the training facilities further in respect of all categories during the Third Plan period, and this augurs well for the furtherance of advanced medical facilities in the State. Table 10-14 presents the data on the progress of medical education and training programmes in the State.

TABLE 10-14

Progress in Medical Education and Training Programmes in the State

Items	1950-51	1955-56	1960-61	1965-66 (Target)
(1)	(2)	(3)	(4)	(5)
Medical Education :				
1. Medical College (Nos.).	2	3	5	5
2. Annual Admissions (Nos.)				
(*a*) G.C.I.M. ...	64	128	(G.C.I.M. course was abolished from the academic year 1960-61)	
(*b*) M.B.B.S. ...	225	310	550	600
Training Programme :				
1. Doctors (Nos.) ...	...	2	14	...
2. Nurses (Nos.) ...	473	567	933	1,333
3. Nurse-Midwives (Nos.)	72	78	84	184
4. Health Visitors (Nos.)	25	25	25	50
5. Nurse Thais/Dhais (Nos.) ...	...	...	900	800
6. Sanitary Inspectors (Nos.) ...	...	...	162	280

Source : Director of Medical Services and Director of Public Health.

Hospitals and Dispensaries in Madras State

During the last decade the hospital facilities in the State have markedly improved. There were 802 hospitals and dispensaries in the State during 1951 and this figure has gone up to 931. The number of beds in these hospitals was only 12,594 in 1951 and this figure has shot up to 24,063 in 1961, thus recording a percentage increase of approximately 100 in the bed strength. In the field of rural medical services also considerable progress has been made. The Primary Health Centres with sub-centres were opened under the Community Development Programme and National Extension Service Schemes. These Primary Health Centres which were only 9 in 1950-51 are now 123 in number in the State, thanks to the two five year plans which have caused their expansion. Next to Madras City where there are 95 hospitals and dispensaries, Thanjavur and Coimbatore have good medical facilities. If bed strength is taken as an indication of medical progress, Madras City and the districts of Madurai, Thanjavur, Chingleput, North Arcot and Coimbatore are better placed than the other areas. Salem district holds the distinction of having increased its bed strength in 1961 by about three times the number it commanded in 1951. Coimbatore has the largest number of Primary Health Centres, namely 20. Next to Coimbatore, Madurai, Thanjavur, Ramanathapuram, Chingleput, North Arcot and South Arcot districts have 10 or more Primary Health Centres. The Third Plan target for Primary Health Centres is 200. The distribution of hospitals and dispensaries cannot be considered to be equitable in all areas of the State. Rural areas of the State do not command good medical facilities. Positively, in a few rural areas the available medical facilities are woefully inadequate. In general, the districts of Tiruchirapalli, Ramanathapuram, Kanyakumari, South Arcot, Salem and Nilgiris are backward in respect of medical facilities.

TABLE 10–15

Number of Hospitals and Dispensaries in the Districts (Base Year Index=100)

District		1950		1951		1955		1956		1960		1961	
		Actual	Index	Actual	Index	Actual	Index	Actual	Index	Actual	Index	Actual	Index
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. *Madras* :													
Hospitals & Dispensaries	...	58	100	58	100	46	79.31	51	87.93	81	139.66	95	163.79
Beds	...	2,534	100	2,634	103.95	4,039	159.39	4,039	159.39	4,311	170.13	4,802	189.50
Primary Health Centres	...	...	...	...	...	...	...	...	...	...	...	...	...
2. *Chingleput* :													
Hospitals & Dispensaries	...	63	100	64	101.59	53	84.13	63	100.00	66	104.76	66	104.76
Beds	...	1,359	100	1,359	100.00	1,678	123.47	1,778	130.83	2,169	159.60	2,266	166.74
Primary Health Centres	...	...	...	...	...	...	...	...	...	10	100.00	10	100.00
3. *North Arcot* :													
Hospitals & Dispensaries	...	71	100	72	101.41	66	92.96	68	95.77	71	100.00	71	100.00
Beds	...	868	100	968	111.52	1,178	135.71	1,367	157.49	1,976	227.65	1,976	277.65
Primary Health Centres	...	4	100	4	100.00	3	75.00	4	100.00	10	250.00	10	250.00
4. *South Arcot* :													
Hospitals & Dispensaries	...	74	100	75	101.35	66	89.19	68	91.89	74	100.00	74	100.00
Beds	...	628	100	728	115.92	619	98.57	719	114.49	872	138.85	946	150.64
Primary Health Centres	...	...	...	...	...	1	100.00	6	600.00	11	1,100.00	11	1,100.00

TABLE 10-15—(*Contd.*)

Number of Hospitals and Dispensaries in the Districts (Base Year Index=100)—(*Contd.*)

District	1950		1951		1955		1956		1960		1961	
	Actual	Index	Actual	Index	Actual	Index	Actual	Index	Actual	Index	Actual	Index
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
5. *Salem* :												
Hospitals & Dispensaries ...	61	100	62	101.64	49	80.33	51	83.61	65	106.56	66	108.20
Beds ...	322	100	422	131.06	686	213.04	736	228.57	1,179	366.15	1,059	328.88
Primary Health Centres ...	...	...	...	...	...	...	2	100.00	9	450.00	9	450.00
6. *Coimbatore* :												
Hospitals & Dispensaries ...	86	100	86	100.00	81	94.19	81	94.19	91	105.81	92	106.98
Beds ...	986	100	1,086	110.14	1,616	163.89	1,616	163.89	2,317	234.99	2,419	245.33
Primary Health Centres ...	5	100	5	100.00	6	120.00	8	160.00	20	400.00	20	400.00
7. *The Nilgiris* :												
Hospitals & Dispensaries ...	25	100	25	100.00	23	92.00	25	100.00	33	132.00	33	132.00
Beds ...	420	100	420	100.00	488	116.19	488	116.19	704	167.62	753	179.29
Primary Health Centres ...	...	...	...	...	...	...	1	100.00	3	300.00	3	300.00
8. *Madurai* :												
Hospitals & Dispensaries ...	64	100	65	101.56	48	75.00	54	84.38	78	121.88	79	123.44
Beds ...	923	100	1,123	121.67	1,126	121.99	1,176	127.41	1,602	173.56	1,827	197.94
Primary Health Centres ...	...	...	...	...	5	100.00	8	160.00	14	280.00	14	280.00
9. *Tiruchirapalli* :												
Hospitals & Dispensaries ...	68	100	68	100.00	68	100.00	68	100.00	78	114.71	79	116.18
Beds ...	753	100	1,480	196.55	897	119.12	897	119.12	1,229	163.21	1,262	167.60
Primary Health Centres ...	...	...	...	...	...	...	4	100.00	8	200.00	8	200.00

10. ***Thanjavur :***													
Hospitals & Dispensaries	...	85	100	85	100.00	80	94.12	80	94.12	92	108.24	92	108.24
Beds	...	1,330	100	803	60.38	2,006	150.83	2,006	150.83	2,178	163.76	2,597	195.26
Primary Health Centres	...	...	...	...	...	...	...	5	100.00	14	280.00	14	280.00
11. ***Ramanathapuram :***													
Hospitals & Dispensaries	...	71	100	71	100.00	52	73.24	61	85.92	80	112.68	80	112.68
Beds	...	907	100	926	102.09	985	108.60	1,085	119.63	1,264	139.36	1,315	144.98
Primary Health Centres	...	...	...	...	...	...	...	4	100.00	11	275.00	11	275.00
12. ***Tirunelveli :***													
Hospitals & Dispensaries	...	71	100	71	100.00	64	90.14	66	92.96	69	97.18	79	111.27
Beds	...	645	100	645	100.00	785	121.71	785	121.71	1,032	160.00	1,358	210.54
Primary Health Centres	...	...	...	...	...	...	...	3	100.00	5	166.67	8	266.67
13. ***Kanyakumari :***													
Hospitals & Dispensaries	...	...	...	...	...	...	...	...	...	24	100.00	25	104.17
Beds	...	...	...	...	...	...	...	...	...	1,355	100.00	1,483	109.45
Primary Health Centres	...	...	...	...	...	...	...	...	...	5	100.00	5	100.00
STATE													
Hospitals & Dispensaries	...	797	100	802	100.63	696	87.33	736	92.35	902	113.17	931	116.81
Beds	...	11,675	100	12,594	107.87	16,103	137.93	16,692	142.97	22,188	190.05	24,063	206.11
Primary Health Centres	...	9	100	9	100.00	15	166.67	45	500.00	120	1,333.33	123	1,366.67

Source : Education and Public Health Department, Madras.

CHAPTER XI

HEALTH AND WELFARE

No report on Vital Statistics or Demography can be complete without a reference to public health of the community. William Farr, in 1875 concluded his 35th Annual Report of the Registrar-General with the following words:

"The great source of misery of mankind is not their numbers, but their imperfections, and the want of control over the conditions in which they live. Without embarrassing ourselves with the difficulties the vast theories present, there is a definite task before us—to determine, from observation, the sources of health and the direct causes of death in the two sexes at different ages and under different conditions. The exact determination of evils is the first step towards their remedies."[1]

Today we can no longer be so complacent in the belief that there is no misery for the world in numbers and it has become important to make observations on how the community lives and dies and what diseases take a heavy toll and in what circumstances. Health statistics have become essential for purposes of research, organisation and planning. In research, statistical enquiries play a prominent role and for organisation, statistics provide clues as to what causes disease and what preventive measures can be applied. In planning medical and public health services, an understanding of what diseases exist in the country and how they are distributed is always of greatest value. The complexity of such services calls for a strict accounting of the money spent and the returns arising therefrom.

No country, however rich can afford to spray anti-malaria insecticides in all habitations throughout its territory. We need some measurement, in terms of incidence and mortality, of where and to what extent malaria is distributed; and when the control programme is under way, we need statistical measures of its effectiveness; and when once the disease is eradicated we must keep it under check by knowing where fresh cases occur. Even the existing programmes need a periodical review if they should prove effective and quite often a skilled application of vital and health statistics is necessary to know what services are needed and how they are meeting current needs. According to Brockington "Statistical measurements must always have been of importance, but in the modern age they have become indispensable. Vital and Health Statistics are the eyes and ears of the community health doctor. They are virtually his only means of knowing the nature of the problems which face him." In other words, health statistics should be one of the first steps in the pursuit of health.

Public health conditions are determined by multifarious factors of life—food-supply in relation to the population, communication net-work, availability of protected water supply, housing conditions, dietary levels of the population, drainage and sanitation facilities, etc. As defined by the WHO Expert Committee on public health administration, "Public Health is the science and art of preventing disease, prolonging life and promoting health and efficiency through organized community efforts for the sanitation of the environment, the control of communicable infections, the education of the individual in personal hygiene, the organisation of medical and nursing services for the early diagnosis and preventive treatment of disease, and the development of social machinery to ensure for every individual a standard of living adequate for the maintenance of health, so organizing these benefits as to enable every citizen to realize his birth right of health and longevity."[2] There are several public health problems which vary in their importance from country to country according to their level of development. New public health hazards crop up in countries where the traditionally considered serious diseases have been eradicated.

Today we are on the threshold of industrialisation which took place in the western countries a hundred years ago, but fortunately we have the experience of those countries to guide us. The measures of social security that have been developed in the west are the products of the experience of these countries designed to alleviate the misery and squalor brought about by the industrial revolution. Many of these measures came into force only after the early travails of industrialisation have been suffered, but fortunately we have accepted the ideal of the welfare state and we have the

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[1] Supplement to the Thirty-Fifth Annual Report of the Registrar–General, London (HMSO), 1875, p. XX.
[2] Fraser Brockington-World Health, Pelican (1958), p. 20.

fruits of social security even at the beginning of our industrialisation.

In the Report on an Enquiry into the Sanitary condition of the Labouring Population of Great Britain, Edwin Chadwick presents the state of affairs in England in 1842 as follows:

"That the various forms of epidemic, endemic and other disease caused, or aggravated, or propagated chiefly amongst the labouring classes by atmospheric impurities produced by decomposing animal and vegetable substances, by damp and filth and close and overcrowded dwellings prevail amongst the population in every part of the Kingdom, whether dwelling in separate houses, in rural villages, in small towns, in the larger towns as they have been found to prevail in the lowest districts of the metropolis."

"That such disease, wherever its attacks are frequent, is always found in connection with the physical circumstances above specified, and that where those circumstances are removed by drainage, proper cleansing, better ventilation and other means of diminishing atmospheric impurity, the frequency and intensity of such disease is abated; and where the removal of the noxious agencies appears to be complete, such disease almost entirely disappears."

"That the formation of all habits of cleanliness is obstructed by defective supplies of water."

"That the annual loss of life from filth and bad ventilation is greater than the loss from death or wounds in any wars in which the country has been engaged in modern times."

"That the ravages of epidemics and other diseases do not diminish but tend to increase the pressure of population."

"That in the districts where the mortality is the greatest the births are not only sufficient to replace the numbers removed by death, but to add to the population."

"That the younger population, bred under noxious physical agencies, is inferior in physical organisation and general health to a population preserved from the presence of such agencies."

"That these adverse circumstances tend to produce an adult population short-lived, improvident, reckless and intemperate, and with habitual avidity for sensual gratifications."

"That the primary and most important measures and, at the same time, the most practicable, and within the recognised province of public administration, are drainage, the removal of all refuse of habitations, streets and roads and the improvement of the supplies of water."

"That the expense of public drainage, of supplies of water laid on in houses, and of means of improved cleansing would be a pecuniary gain, by diminishing the existing charges attendant on sickness and premature mortality."

Health Statistics

Broadly speaking, Health Statistics cover these aspects: (*a*) measurements of the state of health, chiefly morbidity data, which relate to the distribution of illness (as distinct from mortality) in the population; (*b*) factors affecting health, for example, sanitation and nutrition; and (*c*) hospitals, immunizations, etc.,—all or most of which are to promote health, to protect the health of the community or to treat sickness. Health statistics, therefore are a means to measure not only health, but also the factors influencing it and the steps which the community takes to produce it.

The sources of health data are more varied than those of mortality data and are often the by-products of the health services. The major sources of health statistics are listed below:[1]

(1) Surveys by individual enquiry (such as house visiting).

(2) Mass screening.

(3) Census enumeration (i) of sick persons, (ii) of certain defects.

(4) Notification of communicable diseases.

(5) Registration of certain disease (for example Cancer, Rheumatism, etc.).

(6) Certification of certain conditions (for example, for special benefits such as food allowances).

(7) Road accidents.

(8) Industry and occupation (i) accidents, (ii) diseases, (iii) absenteeism.

(9) Armed forces: sickness and recruitment records.

(10) Insurance schemes: (i) social security—voluntary, and statutory, (ii) life and sickness insurance, (iii) voluntary health pension funds, (iv) pensioners and veterans.

(11) Medical and nursing care: (i) hospitals—in-patients and out-patients; (ii) general medical

[1] WHO: Expert Committee on Health Statistics: Third Report, Technical Report Series, No. 25, 1950.

practice, (iii) home visiting and nursing service, (iv) special clinics and hospitals agencies, (v) health and welfare centres (maternity, infant and pre-school), (vi) educational institutions (routine inspections, sickness, absenteeism).

The sources of information for an assessment of the factors affecting health and of the means of health are of two kinds:[1]

(1) Analysis of the use and development of public health services, as for example, (*a*) maternal and child health services—the number of centres, of mothers attending, of individual consultations, (*b*) tuberculosis service—the number of dispensaries, sanatoria beds, patients admitted, (*c*) venereal disease services—the number of centres, the amount of contact tracing etc., (*d*) environmental sanitation—details of services, (*e*) health education—courses of instruction, (*f*) vaccination and immunization—numbers protected.

(2) Estimates of services available for medical care, as for example (*a*) general and special hospitals—numbers and beds, (*b*) mental and mental deficiency hospitals—numbers, beds, vacancies, patient admissions and discharges, (*c*) doctors, dentists, nurses, pharmacists, sanitarians, and veterinarians—numbers; (*d*) family expenditure for each of the various types of health service. There are others which can be devised for particular enquiries.

The data are obtained from the records which are made for statistical or other purposes connected in one way or another with the administration of the health services. They are not registered documents and the persons involved, generally speaking have no interest in the validity of the data or its recording. This has many repercussions on the validity, completeness and accessibility of the data. Further, the data are scattered among many government departments. For instance the hospital statistics are generally compiled by the Medical Department whereas those relating to vaccination will be available with the Public Health Department. The Education Department is concerned with school medical inspection. Further, municipal authorities are responsible for the particulars of the institutions run by them. In addition, many private or voluntary organisations do not furnish statistics to the authorities concerned. Therefore, the compilation of a complete list of existing health statistics often requires many months of search in publications and reports.

In June, 1953, WHO sent out a questionnaire to all member countries in an attempt to learn to what extent health statistics were available in various countries. The information was summarised under 11 headings (excluding notifiable diseases): (1) morbidity data (all illness and special); (2) infirmities (blind and deaf-mute); (3) medical and public health personnel; (4) hospitals (number, beds, etc.); (5) immunization and vaccination; (6) Maternal and Child Health Centres; (7) tuberculosis (pulmonary, non-pulmonary); venereal diseases; (8) drug addiction and alcoholism; (9) mental health (hospitals, institutions for mentally sub-normal children); (10) homes for incurables and aged. Out of the 95 returns listed, only 28 gave sources of morbidity data. Planned surveys of sickness were conducted by Canada, Japan, England and Wales, Scotland, Northern Ireland, Ceylon and Denmark. Otherwise, there was little information available, except records of communicable diseases and some information from hospitals, insurance and school examinations.

Developing countries like India are again at a disadvantage and their need of these is even greater. If the many hazards to health are to be combated successfully, certain basic facts concerning them must be recorded with precision and the assembly of the necessary facts must not be limited to records of compulsory notifiable diseases if gaps in existing medical knowledge are to be filled.[2]

The Scope of this Chapter

The scope of this chapter is however limited for two reasons. One is that several aspects of public health have been already covered in earlier chapters and secondly, the data available to us are rather limited. We have confined ourselves to a discussion of environmental hygiene, immunization and vaccination, food supply and nutrition, industrial hygiene and mental health. As pointed out earlier, public health and social and economic conditions are closely related and no study of public health can be complete without an examination of these factors.

Under the social problems confronting us the most important perhaps are the growth of slums, overcrowding of cities and dearth of housing and the problem of accidents in factories, roads and at homes. We have also collected the statistics of accidents, murders, suicides, etc., from police records and these may well be

[1] Brockington, F. "World Health," Pelican, p. 244.

[2] Edge, P. G. : Vital Statistics and Public Health work in the tropics, London, 1947.

regarded as ancillary indicators of the mental health of the people. We have also given an overall review of the activities of the health administration in the State, their strength and weakness. An evaluation of the past should serve as a guide to the future and we have suggested the directions of our future effort if the goal of Welfare State is to be achieved.

Environmental Hygiene

Many of the diseases known to mankind are the result of bad living and working conditions, contaminated air and water and unclean habits. Dysentery and intestinal diseases follow from contacts with parasites from human excreta carried through streams and other sources of water supply. Sometimes flies settle on the faeces and carry them on their feet and regurgitate them on to food. Likewise, several diseases like tuberculosis, respiratory diseases, etc., are air-borne, and the chance of such infection is greater when people live in crowded localities. The object of environmental hygiene is to provide adequate facilities for the disposal of excreta, make available protected water supply and other amenities which can keep the possibilities of infection to a minimum.

The most important of the tasks of environmental hygiene is protected water supply. While the urban water supply schemes are being executed by municipalities and corporation with loans provided by the Central and State Governments, rural water supply schemes are included in the programmes for community development, local development works and welfare of backward classes. The National Water Supply and Sanitation Programme under the plans gives priority to areas of great water scarcity and salinity and those in which water-borne diseases are endemic. This programme is sponsored by the Government of India mainly for rural areas and is intended for the eradication of water-borne diseases, such as cholera, typhoid, etc., in villages with a population of not more than 5,000. The rural folk in many places collect drinking water from ponds as well as flowing rivers in spite of the availability of good water supply from wells. Protected water supply is non-existent in the rural areas. There are several places in Madras State even now where people utilise for drinking purposes, the water available in stagnant rain-water pools, mosquito-infested dirty tanks, wells and other sources which are hardly free from contamination. Even in places where protected water is supplied, it is not plentiful but is restricted. Good water supply is needed for purposes other than human consumption, just as for washing clothes, utensils, etc. As they will form vehicles of contamination and contagion, sufficient care has to be taken in the utilisation of water for these purposes also. In the following paras, a note on the urban and rural water supply schemes in Madras State is given.

Urban water supply

Before the advent of planning, water supply schemes were in operation in thirty-six municipalities and three panchayats. All these required improvements and extensions. Drainage schemes existed in nine municipalities and two major panchayats, and these were only open drainage schemes serving a limited area. During the First Plan period, works on seventeen water supply schemes and six drainage schemes were in progress. A total expenditure of Rs. 140.72 lakhs was incurred on these works. Fifty-nine water supply and drainage schemes were included under the Second Plan, out of which as many as thirty-two schemes were completed. Twenty-seven schemes were in various stages of progress at the end of 1960-61. At the end of the Second Plan fifty out of 66 municipalities and fourteen out of 151 major panchayats got the benefits of protected water supply. The total population covered was 32 lakhs as against 27 lakhs at the start of the Second Plan. The need for water supply schemes is also increasing. A number of towns and cities suffer from the handicap of lack of adequate assured supply of water for industrial purposes. In the interests of industrial development no less than that of public health, it has become necessary to undertake a massive urban water supply and drainage programme. Thirty-seven water supply and drainage schemes have been completed during the first two plans. However, 16 municipalities and 137 major panchayats still remain without protected water supply system. Almost all municipalities and panchayats lack a proper drainage system. The outlay on urban water supply and drainage has therefore been stepped up to Rs. 7.5 crores to cover more municipalities and major panchayats. The target for the Third Plan is to cover 16 municipalities and 19 panchayats. The idea is to provide water supply to the suburbs of the municipalities, which are also getting urbanised rapidly. It is expected that by the end of Third Plan all municipalities and 41 major panchayats will have the benefit of protected water supply, while 15 municipalities and 6 major panchayats will have the benefit of drainage schemes. The aim is to provide 25 gallons of water per head per day in heavy industrialised areas and 15 gallons in other areas.

The average daily supply of water and the average daily supply per head of population in respect of the different municipalities in the State during 1951 and 1961 are shown in Table 11-1.

TABLE 11-1

Protected Water Supply in Municipalities in Madras State

S. No.	Municipality	Area in Sq. miles	1951 Population	1951 Average daily supply in gallons	1951 Average daily supply per head of population in gallons	1961 Population	1961 Average daily supply in gallons	1961 Average daily supply per head of population in gallons
1.	Arkonam ...	2.50	23,032	132,700	5.8	30,658	191,760	6.3
2.	Arni ...	4.50	24,567	...	...	31,351	192,520	6.1
3.	Bodinayakanur ...	2.15	35,912	...	...	44,914	699,930	15.6
4.	Chidambaram ...	1.84	34,732	300,500	8.7	40,694	464,170	11.4
5.	Chingleput ...	1.96	22,660	230,860	10.2	25,977	430,470	16.6
6.	Coimbatore ...	8.86	197,755	...	...	286,305	4,300,000	15.0
7.	Coonoor ...	5.81	23,902	...	...	30,690	350,000	11.4
8.	Cuddalore ...	10.70	69,084	55,800	0.8	79,168	651,100	8.2
9.	Dindigul ...	5.41	78,361	96,700	1.2	92,947	293,800	3.2
10.	Erode ...	3.22	57,576	525,300	9.1	73,762	875,700	11.9
11.	Gobichettipalayam ...	2.90	30,354	...	...	27,004	354,790	13.1
12.	Gudiyatham ...	1.82	45,667	283,500	6.2	50,384	382,350	7.6
13.	Kancheepuram ...	4.50	84,810	...	...	92,714	1,113,700	12.0
14.	Karaikudi ...	5.49	38,453	22,550	0.6	43,698	75,880	1.7
15.	Karur ...	2.33	42,155	406,850	9.7	50,564	527,200	10.4
16.	Kumbakonam ...	4.42	91,643	420,000	4.6	92,581	1,461,800	15.8
17.	Madurai ...	8.56	361,781	...	...	424,810	3,655,940	8.6
18.	Melapalayam ...	6.50	37,653	...	...	38,806	187,200	4.8
19.	Mettupalayam ...	2.70	27,516	...	...	36,496	301,130	8.3
20.	Nagappatinam ...	5.44	57,854	...	...	59,063	909,270	15.4
21.	Nagercoil ...	8.40	79,284	...	...	106,207	979,850	9.2

TABLE 11-1—(*Contd.*)

Protected Water Supply in Municipalities in Madras State—(*Contd.*)

S. No.	Municipality		Area in Sq. miles	1951			1961		
				Population	Average daily supply in gallons	Average daily supply per head of population in gallons	Population	Average daily supply in gallons	Average daily supply per head of population in gallons
22.	Ootacamund	...	12.48	41,370	...	...	50,140	657,300	13.1
23.	Palani	...	2.03	34,486	...	...	39,832	180,000	4.5
24.	Palayamkottai	...	7.54	40,010	...	...	51,002	757,000	14.8
25.	Periyakulam	...	0.94	31,000	...	...	36,335	416,750	11.5
26.	Pollachi	...	5.35	41,744	240,500	5.8	54,369	476,660	8.8
27.	Pudukkottai	...	5.00	44,527	181,870	4.1	50,488	200,740	4.0
28.	Salem	...	7.89	202,335	...	...	249,145	2,130,000	8.5
29.	Shencottah	...	1.03	17,332	...	...	20,528	191,400	9.3
30.	Srirangam	...	5.07	36,702	195,000	5.3	41,949	253,150	6.0
31.	Srivilliputhur	...	2.17	40,436	...	...	46,816	460,530	9.8
32.	Thanjavur	...	9.08	100,680	971,000	9.6	111,099	1,442,330	13.0
33.	Tiruchirapalli	...	8.98	218,921	4,022,500	18.4	249,862	5,737,090	23.0
34.	Tiruppur	...	10.50	52,479	...	...	79,773	50,000	0.6
35.	Tiruvallur	...	4.20	18,847	117,350	6.2	19,757	118,820	6.0
36.	Tiruvannamalai	...	5.10	40,718	234,830	5.8	46,441	314,600	6.8
37.	Tuticorin	...	5.20	98,866	957,720	9.7	124,230	1,688,360	13.6
38.	Tindivanam	...	8.65	29,651	...	...	34,342	116,580	3.4
39.	Vellore	...	4.17	106,024	...	...	113,742	1,844,420	16.2
40.	Virudhunagar	...	2.47	46,309	280,600	6.1	54,827	371,420	6.8
41.	Wallajapet	...	1.03	12,601	...	...	13,179	108,050	8.2
42.	Ranipet	...	4.00	18,945	...	...	22,974	125,000	5.4

As against 19 municipalities in 1951, 42 municipalities have completed protected water supply arrangements in 1961. Those municipalities which were supplying water in 1951 have considerably increased their supply during the 10 years and besides several municipalities have started water supply schemes. Tiruchirapalli is perhaps the only town where water supply can be considered somewhat adequate. The per capita supply of water in Tiruchirapalli was 18.4 gallons per day in 1951 and this has gone up to 23.0 in 1961. The per capita water supplies in those municipalities which had schemes in 1951 have increased in 1961 except in Pudukkottai and Tiruvallur, where it has gone down because of inadequate increase in the water supply commensurate with population increase. Of the municipalities which supply water, considering the per capita supply of water per day, the municipalities of Dindigul, Karaikudi, Melapalayam, Palani, Pudukkottai, Tiruppur and Tindivanam lag far behind others with less than 5 gallons per day. The towns where water supply can be considered as somewhat satisfactory are Bodinayakanur, Chingleput, Coimbatore, Kumbakonam, Nagappattinam and Vellore.

In Madras City, protected water supply is made available by the Corporation from the Kilpauk Water Works where it is filtered and chlorinated. To augment supply in north Madras, a filtering station was constructed and got ready at Robinson Park, Royapuram. To ensure the quality of the water supplied, the samples at various stages and places are taken and analysed at Water Analysts' Laboratory and immediate steps are taken to rectify the deficiency in the quality. The slum dwellers and the residents in extended areas are also provided with the benefit of protected water supplied in lorries and by storing in steel tanks and masonry tanks. During 1960-61, 11,605 million gallons of water was supplied to the citizens and taking the population as roughly 18 lakhs, it works out to 18.20 gallons per head per day. This is poor as in an industrially developed place like Madras City, the average per capita requirement will be high. Further, adequate provision should be made for the floating population as well. Considering all these aspects, we have to conclude that the water-supply for Madras City is inadequate.

Summing up the above discussion, we may conclude that hardly 40% of the urban population has been covered by protected water supply schemes and even the existing water supply in these areas is inadequate. Public health experts have suggested a norm of 20 gallons of water per individual per day and for industrial cities, a higher norm is required. Our plans for urban water supply have to be formulated, keeping in view the future trends in population of these municipalities and also to ensure that the above norm is reached in ten to fifteen years.

Rural water supply

Wells form the major source of water supply in the rural areas of the State. Rural water supply schemes are dealt with at the block level, but are supplemented by the National Water Supply and Sanitation Programme which deals with the provision of water supply to groups of villages through works requiring a measure of technical skill in design and construction. There is a comprehensive rural water supply scheme under which drinking water is to be provided for rural areas with a population of not more than 10,000 by providing

(i) bore-wells with pump attached
(ii) closed wells with overhead tanks and taps
(iii) connections from water mains of municipalities; and
(iv) draw wells

During the First Plan, 4,267 works were completed under this programme. As against the target for the Second Plan period, *viz.*, 8,500 wells and 340 composite schemes, 9,801 wells and 204 composite schemes were completed. According to a rough estimate for 1961, approximately 3,000 villages and 2,000 hamlets go without adequate drinking water in the State. The target for the Third Plan is hence fixed at 6,520 wells and 296 composite schemes. Apart from this, water supply facilities are to be provided in 682 villages which are affected by guinea-worm disease. According to the National Water Supply and Sanitation Scheme, water supply will be provided by means of bore wells or piped water-supply with overhead tanks and taps and repairs to old wells. This scheme is under execution in South Arcot, Thanjavur, Tiruchirapalli, Ramanathapuram and Tirunelveli districts where 378 villages have been selected for implementation of the scheme. The scheme has been extended to 98 villages in Madurai district, 90 villages in North Arcot district and 90 villages in Chingleput district.

In the 'Health and Rural Sanitation' Programme, under community development projects, drinking water wells have been sunk since 1954-55 with Government subsidy. The number of wells sunk every year during 1954-55 to 1960-61, district-wise are given in Table 11-2.

Drainage Facilities

Closely linked to the problem of water supply is the provision of drainage facilities and the proper disposal of human faeces. To the scientifically trained public

TABLE 11-2

Drinking water wells sunk under Community Development Programme

District	1954-55	1955-56	1956-57	1957-58	1958-59	1959-60	1960-61
Madras ...	...	...	...	...	...	...	...
Chingleput ...	85	33	52	244	362	156	75
North Arcot ...	17	29	28	44	129	144	202
South Arcot ...	64	100	164	157	161	166	67
Salem ...	22	24	82	231	135	130	230
Coimbatore ...	69	332	337	195	196	142	242
Nilgiris ...	20	...	...	34	21	2	2
Madurai ...	152	256	149	231	277	233	312
Tiruchirapalli ...	38	135	114	188	449	274	280
Thanjavur ...	...	...	...	...	...	...	250
Ramanathapuram ...	...	...	...	...	...	...	331
Tirunelveli ...	51	39	38	77	101	308	172
Kanyakumari ...	...	...	3	24	55	68	103
State ...	518	948	967	1,425	1,886	1,623	2,266

health worker, it seems to offer little difficulty in finding a solution. And yet local beliefs and customs are continually stultifying his efforts. For instance, defecation in the open spaces, whether due to local beliefs or for aesthetic reasons is a major menace. The rains wash down the parasites from excreta into streams; flies settle on the faeces, carry them on their feet, and regurgitate them on the food. Cholera and many intestinal disorders are spread in this manner.

The problem of drainage is not as serious in rural areas as in urban areas. Because of limitations of space and crowding of population, the drainage should be adequate enough to carry a large volume of sewerage. There is a scheme under which the available urban wastes, night soil, etc., are to be utilised for the production of good quality compost on scientific and hygienic lines. The scheme is run by 66 municipalities and 267 panchayats besides 3 townships and the Madras Corporation.

In the rural areas, closely allied to the water supply scheme, measures are under implementation to construct latrines in individual houses and community latrines for common use of the villagers. Provision of sanitary type of latrines is engaging the attention of the Public Health Department and Research-*cum*-Action Projects for rural sanitation are in progress.

Vaccination

The practice of vaccination against small-pox is the greatest triumph of preventive medicine. Studies in several countries have shown that among the unprotected, the damage caused by small-pox is considerable. It is said that nearly half of the unvaccinated who are attacked die and of those who survive, a larger proportion are disfigured for life or maimed by the loss of one or both eyes, or crippled by injuries to their joints. Small-pox is a highly contagious disease and it spares neither children, youth or the aged. Very few unvaccinated people are naturally immune to small-pox. Apart from causing a formidable toll of death, small-pox in India is the cause of much suffering and disfigurement and for the greater proportion of the blindness and deafness met with. Vaccination confers a high

degree of immunity from the disease, but, even when immunity is not complete, vaccination profoundly modifies its course and its severity. The degree of protection conferred by vaccination depends mainly upon the period which has elapsed since its performance and on the mode of its performance. The protection given by vaccination in three or four places is much greater than that conferred by vaccination in only one spot. The following statistics collected from 5,000 cases demonstrate these points well :*

		Mortality per cent
1. Not vaccinated	...	35.00
2. Vaccination doubtful (no scar visible)	...	23.57
3. Vaccinated		
(*a*) having one scar	...	7.73
(*b*) having two scars	...	4.70
(*c*) having three scars	...	1.95
(*d*) having four scars	...	0.55

It is found that mortality is highest in the unvaccinated section and diminishes with the number of scars. Those with one scar have only one-fifth the mortality rate of those who are not vaccinated. Another interesting study is the fatality in vaccinated population belonging to different age groups.

Table 11-3 shows the incidence of small-pox in a vaccinated population according to age : *

TABLE 11-3

Incidence of small-pox among vaccinated population

Age		Incidence	Fatality
Under 5	...	0.36	0.8
5 to 10	...	0.67	2.0
10 to 15	...	1.90	1.7
15 to 20	...	3.60	2.0
20 to 30	...	2.80	5.4
Above 30	...	1.00	10.4

A rise occurs in both the number of attack and mortality as persons grow older indicating that protection from primary vaccination in infancy diminishes gradually and revaccination is required at about 10 to 12 years.[1]

Vaccination is compulsory under the Madras City Municipal Act, 1919 and the Madras District Municipalities Act, 1920. Children are to be produced for vaccination at the nearest vaccination depot soon after attaining the age of six months.

The Director of Public Health controls the administration of vaccination in the State. Madras State through its continuous vaccination programmes through the years has now made considerable progress in reducing mortality from small-pox during the last decade. There were 1,744 deaths due to small-pox in the State during 1960 as against 7,930 in 1951. However, since small-pox incidence is known for its cyclical trend, decennial mortality should be taken as a better indicator. The death rate due to small-pox was 336 per lakh of population in 1921-31 and in 1951-61 it is only 92. The extent of small-pox deaths in the different areas in 1960 is shown below:

TABLE 11-4

Small-pox Mortality in different areas, 1960

Areas		No. of deaths	Death rate per lakh of population
State	...	1,744	5
Rural Areas	...	894	4
Urban Areas	...	850	9
Municipal Towns	...	754	12
Census Towns	...	96	3

Madras City continues to record the largest number of deaths due to small-pox and is responsible for 30% of the total deaths from small-pox in the State. The districts of Chingleput, North Arcot, South Arcot and Thanjavur report sporadic cases throughout the year, while stray cases are recorded in all other districts except Nilgiris and Kanyakumari which are practically free. The vaccination programmes have reduced the

* *Source* : Public Health Code, Part II, Vaccination, 1930, p. 111—Memorandum on Small-pox by Col. Russell.

[1] *Source :* Public Health Code, Part III, Vaccination, 1930, p. 115.

incidence of small-pox in all districts except perhaps in Madurai and Tirunelveli. Over two-thirds of the deaths from small-pox are among children below 10 years of age. This reveals the possibility, that in spite of the strict measures, several infants escape primary vaccination. Mass vaccination and revaccination campaigns are launched in the affected and surrounding areas. Measures are taken to detect unprotected children for vaccination. Vaccination is compulsory for all and evasion is a punishable offence under the Acts, Madras City Municipal Act, 1919, Madras District Municipalities Act, 1920 and the Madras Panchayats Act, 1958. It has been found that there are several unprotected cases noticed in a number of places. During 1960, the normal off-season was cancelled to enable vaccinators to carry out intensive vaccination campaign in the affected and surrounding areas. A National Small-pox Eradication Programme has been worked out by the Central Expert Committee of the Indian Council of Medical Research jointly with the representatives of the State's Experts Committee on small-pox. It is proposed to vaccinate the entire population within a period of 3 years and a provision of Rs. 60 lakhs has been made for this in the Third Plan. Due to the continued prevalence of small-pox incidence in the City of Madras and the inadequate measures undertaken by the Madras Corporation, the Government have recently empowered the Director of Public Health to inspect, control and supervise the operations of the Madras Corporation in the field of small-pox control. A scheme has been drawn up which envisages the complete control and eventual eradication of small-pox from Madras City by planned, systematic and intensive vaccination of the entire population within a period of four months.

In the remaining districts, due to dearth of qualified personnel, temporary trained vaccination staff are appointed during epidemics. Table 11-5 shows the number of persons vaccinated and revaccinated in different areas in 1960.

It may be seen from Table 11-5 that revaccinations are larger in number than the primary vaccinations. Railways, medical institutions and ports contribute to 75,000 revaccinations. During 1960, the percentages of success among primary and revaccination were 93.9 and 12.1 respectively. The total number of successful primary vaccinations was 866,368.

As a preliminary to intensive vaccination campaign, a pilot project for the eradication of small-pox was undertaken in Chingleput district. Thereafter, a mass vaccination programme in Madras City, mopping up operations for the sections of population left over in Chingleput district Pilot Project area and in the Tiruttani taluk of the Chingleput district were also conducted. The programme has further been extended to North Arcot district and the work is under progress. Proposals for the extension of the programme to other districts of the State are under way.

TABLE 11-5

Vaccination and revaccination rates, 1960

Area/Agency	Primary Vaccination	Rate per 1,000 persons	Revaccination	Rate per 1,000 persons	Total	Rate per 1,000 persons
Non-Municipal Areas	908,802	33	3,531,282	128	4,440,084	161
Health Unit, Poonamallee ...	2,640	42	8,423	134	11,063	176
Municipal Towns	226,208	36	1,589,319	255	1,815,527	291
Railways	2,114	...	55,120	...	58,960	...
Medical Institutions and Ports ...	3,840	...	20,143	...	22,257	...
Total ...	1,143,604	34	5,204,287	154	6,347,891	188

Source: Report on the Health Conditions in Madras State, 1960, Government of Madras (1963), p. 75.

An abstract of the work done during 1-9-'60 to 21-1-'61 in the Pilot Project at Chingleput district is given below:

Population of the Pilot Project District: 20 lakhs.

Population covered so far in five taluks: 11.56 lakhs.

Vaccinations done

Primary vaccination	...	41,650
Revaccination	...	741,548
Total	...	783,198
Percentage of population covered by vaccination	...	67.8

Number of vaccinations inspected

Primary vaccination	...	17,765
Revaccination	...	257,009
Percentage of Primary vaccination inspected	...	42.6
Percentage of Revaccinations inspected	...	34.7

Percentage of success

Primary vaccination	...	97.8
Revaccination	...	40.0
Number of vaccinations per vaccinator per working day	...	75

In addition to the vaccinations performed by the pilot staff, 185,710 vaccinations have also been done by the permanent health staff in these areas during the period. In all, 84% of the population in the project area are protected by vaccination. The permanent health staff will mop up all cases left unvaccinated by the Pilot Project Staff. The high percentage of success is due to the use of fresh and potent vaccine issued daily from the refrigerators and good vaccination technique and proper supervision.

Table 11-6 shows the particulars of vaccination in Madras State during 1960 and Tables 11-7 and 11-8 give details for municipal and non-municipal areas.

It may be seen from Table 11-8 that in the districts of Salem and South Arcot, over 5.5 lakhs of people have been vaccinated during the year. The percentage of success in respect of primary vaccinations is quite good as may be seen from column 15 of the table. The percentage of success among the cases where results are known is the highest in Chingleput district with 95.8% and lowest in Thanjavur with 88.4%. In the case of revaccination, the highest percentage of successful cases is recorded in Tiruchirapalli district (15.1%) and the lowest in Thanjavur (9.1%).

The necessity for revaccination needs no over-emphasis. Vaccination in infancy does not invariably secure immunity in the adult, although it reduces the virulence of an attack. One attack of small-pox secures protection, but second attacks are not unknown and the protection of all attacks tends to wear off in course of time. Besides, the susceptibility of small-pox varies remarkably in different persons. No data, however, are available to show the proportion of attacks and deaths from small-pox which occurred among persons who have been vaccinated. Such cases are due to the failure of the primary vaccination operation and a revaccination can safeguard against such possibilities. Though the ideal would be to vaccinate once in seven years, in practice it is found sufficient to insist on infantile vaccination being followed by revaccination after 12 years.

Immunisation

Under the plan, there is a scheme for the immunisation of pre-school children of ages 1 to 5 against whooping cough, diphtheria and tetanus with triple vaccine. The scheme is to be implemented through the Primary Health Centres and sub-centres where all the children of ages 1 to 5 will be collected and given injections. It is proposed to cover about 7.92 lakhs of children during the plan period and a provision of Rs. 7 lakhs under the Third Plan has been made for this purpose. About 3,000 children will be benefited in each Development Block.

Cholera spreads more easily in towns and cities than in the rural areas. It is primarily a water-borne disease and in those districts which are intersected by rivers or streams, the infection rapidly spreads down the river courses. The cholera germ may be harboured by apparently healthy persons and many individuals after recovering from an attack continue to harbour the germ for varying periods. Even where protected water supply is available, cholera may spread due to insufficiency in the water supply or flaws in the purification or distribution methods. Anti-Cholera vaccine and inoculation are valuable in the prevention of this disease.

TABLE 11-6

Particulars of Vaccination in Madras State, 1960

Agencies	Total No. of persons vaccinated		Total No. of operations		Percentage of successful cases in which the results were known		Number of children successfully vaccinated			
	Primary vaccination	Revaccination	Primary vaccination	Revaccination	Primary vaccination	Revaccination	0—1 Yr.	1—5 Yrs.	5—10 Yrs.	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Non-Municipal Areas ...	908,802	3,531,282	925,502	3,532,044	92.59	12.69	339,064	266,225	36,084	643,087
Municipal Towns ...	226,208	1,589,319	228,731	1,589,347	98.04	9.24	139,906	66,813	8,672	215,821
Poonamallee Health Unit ...	2,640	8,423	2,711	8,423	96.22	16.27	1,461	722	31	2,216
Medical Institutions and Ports ...	3,840	55,120	3,857	55,121	94.97	59.38	959	1,776	485	3,227
Railways ...	2,114	20,143	2,114	20,143	98.53	18.94	873	1,036	103	2,017
Total ...	1,143,604	5,204,287	1,162,915	5,205,078	93.92	12.08	482,263	336,572	45,375	866,368

Source : Report on Health conditions in Madras State, 1960. [Government of Madras (1963), p. 196.]

TABLE 11-7

Statistics of Vaccination in the Municipalities of Madras State for the Calendar Year, 1960

Serial Number and name of Municipalitie		Mid-Year estimated population for 1960	Total No. of persons vaccinated			Primary vaccination							
			Males	Females	Total	Total No. of operations	Successful					Un-success-ful	Un-known
							0—1 Year	1—5 Years	5—10 Years	10 Yrs. & above	Total		
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Madras	...	1,915,000	237,486	234,719	472,205	54,662	38,173	15,510	910	18	54,611	12	39
2. Kancheepuram	...	94,300	64,883	57,949	122,832	4,328	2,902	1,347	79	...	4,328	...	...
3. Tiruvellore	...	24,600	2,902	3,872	6,774	427	233	145	19	...	397	13	17
4. Chingleput	...	27,200	10,042	8,378	18,420	1,340	620	367	66	...	1,053	6	281
5. Tiruvottiyur	...	30,300	2,630	4,879	7,509	1,082	234	593	80	15	922	98	62
6. Vellore	...	138,200	21,214	32,464	53,678	5,292	3,007	1,775	88	...	4,870	2	420
7. Tiruvannamalai	...	47,400	19,650	13,092	32,742	1,977	1,265	673	39	...	1,977	...	...
8. Gudiyatham	...	57,800	7,001	4,765	11,766	2,600	1,839	544	32	...	2,415	89	96
9. Vaniyambadi	...	45,600	3,392	3,634	7,026	1,766	1,168	410	26	...	1,604	111	51
10. Tirupathur	...	30,700	2,402	3,126	5,528	1,641	1,143	389	4	...	1,536	...	105
11. Walajapet	...	14,000	1,767	1,121	2,888	466	409	24	5	...	438	...	28
12. Ambur	...	47,700	2,380	2,176	4,556	1,916	1,105	625	60	...	1,790	43	83
13. Arni	...	29,100	3,039	2,832	5,871	944	748	189	7	...	944	...	...
14. Arkonam	...	30,100	1,205	1,724	2,929	673	213	352	5	...	570	26	77

15. Ranipet	...	23,300	4,429	4,348	8,777	741	584	132	12	...	728	4	9
16. Arcot	...	25,400	3,547	2,947	6,494	1,171	693	147	11	...	851	76	244
17. Cuddalore	...	77,000	8,564	10,386	18,950	3,314	1,779	1,535	...	...	3,314	...	...
18. Chidambaram	...	42,700	17,133	12,030	29,163	1,703	930	578	98	...	1,606	8	89
19. Villupuram	...	46,800	4,996	4,529	9,525	1,315	619	661	13	...	1,293	11	11
20. Tindivanam	...	40,400	4,143	3,315	7,458	1,325	373	744	9	...	1,126	142	57
21. Thanjavur	...	130,500	17,773	14,853	32,626	3,170	1,848	978	78	...	2,904	12	254
22. Kumbakonam	...	114,600	19,679	12,236	31,915	4,053	1,611	1,928	351	35	3,925	2	126
23. Nagapattinam	...	62,400	5,517	6,855	12,372	5,548	1,825	2,294	1,417	...	5,536	11	1
24. Mayuram	...	53,500	14,552	9,882	24,434	1,678	792	586	77	15	1,470	...	208
25. Mannargudi	...	36,000	3,656	3,145	6,801	1,336	877	303	34	...	1,214	12	110
26. Tiruvarur	...	31,900	15,706	17,024	32,730	2,435	552	1,278	431	...	2,261	15	159
27. Tiruchirapalli	...	274,300	36,413	25,813	62,226	8,735	3,599	3,522	436	112	7,669	238	828
28. Karur	...	55,800	3,748	2,796	6,544	1,533	1,002	523	8	...	1,533	...	...
29. Srirangam	...	46,100	6,204	6,630	12,834	1,860	1,147	412	21	...	1,580	32	248
30. Pudukottai	...	54,200	19,658	18,116	37,774	3,800	1,738	1,514	216	7	3,475	51	274
31. Madurai	...	476,200	75,407	82,090	157,497	23,441	14,528	4,440	786	118	19,872	1,835	1,734
32. Dindigul	...	99,000	23,416	27,536	50,952	5,081	3,181	1,784	93	...	5,058	...	23
33. Bodinayakanur	...	42,900	2,477	2,620	5,097	1,015	595	216	29	...	840	73	102
34. Periyakulam	...	35,800	12,653	10,964	23,617	1,771	1,307	411	42	...	1,760	9	2
35. Palni	...	43,600	21,373	23,509	44,882	2,140	1,128	805	83	...	2,016	8	116

TABLE 11-7—(*Contd.*)

Statistics of Vaccination in the Municipalities of Madras State for the Calendar Year, 1960—(*Contd.*)

Serial Number and name of Municipalities	Primary vaccination—(*Contd.*)		Revaccination								Total No. of persons vaccinated	
	No. of cases in which the results were known [Cols. (6) —(13)]	Percentage of successful cases in which the results were known [Cols. (11) ÷ (14)]	Total No. of operations	Successful of all ages	Un-successful	Un-known	No. of cases in which the results were known [Cols. (16) —(19)]	Percentage of successful cases in which the results were known [Cols. (17)÷(20)]	Total No. of successful operations [Cols. (11) + (17)]		Primary vaccination	Re-vacci-nation
	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)		(23)	(24)
1. Madras ...	54,623	99.98	417,555	16,457	313,779	87,319	330,236	4.98	71,068		54,650	417,555
2. Kancheepuram ...	4,328	100.0	118,504	12,553	95,039	10,912	107,592	11.67	16,881		4,328	118,504
3. Tiruvellore ...	410	96.83	6,347	2,042	3,959	346	6,001	32.36	2,439		427	6,347
4. Chingleput ...	1,059	99.43	17,080	889	14,990	1,201	15,879	5.60	1,942		1,340	17,080
5. Tiruvottiyur ...	1,020	90.39	6,427	1,671	2,817	1,939	4,488	37.23	2,593		1,082	6,427
6. Vellore ...	4,872	99.96	48,388	5,808	33,888	8,692	39,696	14.63	10,678		5,290	48,388
7. Tiruvannamalai ...	1,977	100.0	30,765	370	29,888	507	30,258	1.22	2,347		1,977	30,765
8. Gudiyatham ...	2,504	96.45	9,229	196	8,669	364	8,865	2.21	2,611		2,537	9,229
9. Vaniyambadi ...	1,715	93.53	5,260	892	4,055	313	4,947	18.03	2,496		1,766	5,260
10. Tiruppattur ...	1,536	100.0	3,898	609	3,245	44	3,854	15.80	2,145		1,630	3,898
11. Walajapet ...	438	100.0	2,422	81	1,699	642	1,780	4.55	519		466	2,422
12. Ambur ...	1,833	97.65	2,640	283	2,111	246	2,394	11.82	2,073		1,916	2,640
13. Arni ...	944	100,0	4,927	784	3,656	487	4,440	17,66	1,728		944	4,927

14. Arkonam ...	596	95.64	2,256	234	1,246	776	1,480	15.81	804	673	2,256
15. Ranipet ...	732	99.45	8,036	234	5,426	2,376	5,660	4.13	962	741	8,036
16. Arcot ...	927	91.80	5,323	976	1,809	2,538	2,785	35.04	1,827	1,171	5,323
17. Cuddalore ...	3,314	100.0	15,636	2,520	10,314	2,802	12,834	19.64	5,834	3,314	15,636
18. Chidambaram ...	1,614	99.50	27,460	5,143	14,007	8,310	19,150	26.86	6,749	1,703	27,460
19. Villupuram ...	1,304	99.16	8,210	706	6,214	1,290	6,920	10.20	1,999	1,315	8,215
20. Tindivanam ...	1,268	88.80	6,207	631	4,355	1,221	4,986	12.66	1,757	1,273	6,184
21. Thanjavur ...	2,916	99.59	29,464	2,358	22,705	4,401	25,063	9.41	5,262	3,162	29,464
22. Kumbakonam ...	3,927	99.95	27,862	1,416	21,804	4,642	23,220	6.10	5,341	4,053	27,862
23. Nagapattinam ...	5,547	99.80	6,824	740	5,523	561	6,263	11.82	6,276	5,548	6,824
24. Mayuram ...	1,470	100.0	22,756	879	16,442	5,435	17,321	5.07	2,349	1,678	22,756
25. Mannargudi ...	1,226	99.02	5,489	278	3,755	1,456	4,033	6.89	1,492	1,312	5,489
26. Tiruvarur ...	2,276	99.34	30,299	496	25,084	4,719	25,580	1.94	2,757	2,431	30,299
27. Tiruchirapalli ...	7,907	96.99	53,503	3,756	40,771	8,976	44,527	8.44	11,425	8,729	53,497
28. Karur ...	1,533	100.0	5,011	556	2,619	1,836	3,175	17.51	2,089	1,533	5,011
29. Srirangam ...	1,612	98.01	10,995	755	8,895	1,345	9,650	7.82	2,335	1,839	10,995
30. Pudukottai ...	3,526	98.55	33,977	3,265	23,946	6,766	27,211	12.00	6,740	3,797	33,977
31. Madurai ...	21,707	91.55	135,391	3,899	116,738	14,754	120,637	3.23	23,771	22,106	135,391
32. Dindigul ...	5,058	100.0	45,871	1,271	42,551	2,049	43,822	2.90	6,329	5,081	45,873
33. Bodinayakanur ...	913	92.0	4,082	80	2,959	1,043	3,039	2.63	920	1,015	4,082
34. Periyakulam ...	1,769	99.49	21,846	3,317	8,810	9,719	12,127	27.35	5,077	1,771	21,846
35. Palni ...	2,024	99.60	42,742	1,746	38,517	2,479	40,263	4.34	3,762	2,140	42,742

TABLE 11-7—(*Contd.*)

Statistics of Vaccination in the Municipalities of Madras State for the Calendar Year, 1960—(*Contd.*)

Serial Number and name of Municipalities	Mid-Year estimated population for 1960	Total No. of persons vaccinated			Primary vaccination							
					Total No. of operations	Successful					Un-success-ful	Un-known
		Males	Females	Total		0—1 Year	1—5 Years	5—10 Years	10 Yrs. & above	Total		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
36. Kodaikanal ...	12,100	1,050	1,234	2,284	467	416	49	1	...	466	...	1
37. Cumbum ...	31,300	1,331	974	2,305	1,845	918	434	9	...	1,361	56	428
38. Rajapalayam ...	74,500	5,662	5,864	11,526	2,531	2,262	228	12	...	2,502	3	26
39. Srivilliputtur ...	45,800	5,026	3,660	8,686	1,201	1,044	156	...	...	1,200	1	...
40. Virudhunagar ...	57,300	17,176	14,853	32,029	4,231	1,945	1,850	425	11	4,231	...	...
41. Karaikudi ...	47,400	4,760	3,790	8,550	2,110	1,449	282	64	47	1,842	...	268
42. Devakottai ...	27,500	3,368	3,454	6,822	642	453	144	23	4	624	17	1
43. Sivakasi ...	28,200	1,316	1,376	2,692	903	691	170	...	...	861	42	...
44. Aruppukottai ...	61,200	4,602	3,832	8,434	1,443	1,330	65	2	...	1,397	17	29
45. Ramanathapuram ...	29,600	8,825	7,003	15,828	1,740	723	468	128	...	1,319	200	221
46. Tuticorin ...	120,600	10,759	16,237	26,996	3,927	3,152	432	139	8	3,731	50	146
47. Tirunelveli ...	85,400	13,009	8,972	21,981	2,772	2,074	451	45	...	2,570	69	33
48. Palayamkottai ...	48,400	5,690	5,882	11,572	1,770	1,295	371	...	...	1,666	34	70
49. Melapalayam ...	43,400	2,543	3,508	6,051	731	546	132	15	...	693	...	38
50. Shencottah ...	19,700	1,120	1,080	2,200	717	93	311	87	...	491	50	176

51. Salem	...	270,100	34,590	31,445	66,035	11,995	8,801	3,078	78	3	11,960	19	16
52. Rasipuram	...	28,100	1,920	1,379	3,299	664	211	192	59	...	462	94	108
53. Coimbatore	...	260,700	41,292	36,049	77,341	8,302	6,148	1,661	33	...	7,842	98	362
54. Erode	...	74,500	16,127	13,548	29,675	3,262	2,173	882	5	...	3,060	146	56
55. Tiruppur	...	70,600	7,256	7,401	14,657	2,821	1,592	1,031	84	...	2,707	5	109
56. Pollachi	...	57,200	6,213	6,564	12,777	2,512	1,814	584	114	...	2,512	...	...
57. Dharapuram	...	27,400	2,553	2,255	4,808	1,159	800	279	41	...	1,120	37	2
58 Udumalpet	...	28,500	2,502	2,579	5,081	1,194	560	436	173	8	1,177	...	17
59. Mettupalayam	...	36,600	4,595	3,382	7,977	1,516	856	530	33	...	1,419	21	76
60. Gobichettipalayam	...	43,600	2,258	1,340	3,598	981	584	262	41	...	887	...	94
61. Kurichi	...	26,500						Not received					
62. Ootacamund	...	52,100	3,986	3,510	7,496	1,831	1,363	416	52	...	1,831	...	...
63. Coonoor	...	28,700	2,399	2,611	5,010	940	568	139	10	1	718	11	211
64. Nagercoil	...	105,100	13,073	9,735	22,808	7,112	1,811	3,575	1,266	...	6,652	358	102
65. Colachel	...	15,700	1,787	1,716	3,453	531	325	206	...	...	531	...	...
66. Kuzhithurai	...	12,700	1,086	796	1,882	97	25	58	4	3	90	4	3
67. Padmanabhapuram	...	14,800	2,229	2,053	4,282	505	117	207	64	25	413	49	43
Grand total	...	6,230,000	931,090	884,437	1,815,527	228,731	139,906	66,813	8,672	430	215,821	4,320	8,590

TABLE 11-7—(*Contd.*)

Statistics of Vaccination in the Municipalities of Madras State for the Calendar Year, 1960—(*Contd.*)

Serial Number and name of Municipalities	Primary vaccination—(*Contd.*)		Revaccination							Total No. of persons vaccinated	
	No. of cases in which the results were known [Cols. (6) —(13)]	Percentage of successful cases in which the results were known [Cols. (11) ÷ (14)]	Total No. of operations	Successful of all ages	Un-successful	Un-known	No. of cases in which the results were known [Cols. (16) —(19)]	Percentage of successful cases in which the results were known [Cols. (17)÷(20)]	Total No. of successful operations [Cols. (11) + (17)]	Primary vaccination	Re-vacci-nation
	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
36. Kodaikanal ...	466	100.0	1,817	461	1,198	158	1,659	27.79	927	467	1,817
37. Cumbum ...	1,417	96.05	460	65	236	159	301	21.59	1,426	1,845	460
38. Rajapalayam ...	2,505	99.88	8,995	623	6,583	1,789	7,206	8.65	3,125	2,531	8,995
39. Srivilliputhur ...	1,201	99.92	7,486	744	6,479	263	7,223	10.30	1,944	1,200	7,486
40. Virudhunagar ...	4,231	100.0	27,798	4,621	19,721	3,456	24,342	18.98	8,852	4,231	27,798
41. Karaikudi ...	1,842	100.0	6,440	386	5,348	706	5,734	6.73	2,228	2,110	6,449
42. Devakottai ...	641	97.35	6,196	673	5,021	502	5,694	11.81	1,297	626	6,196
43. Sivakasi ...	903	95.35	1,798	214	1,584	...	1,798	11.90	1,075	894	1,798
44. Aruppukottai ...	1,414	98.80	7,008	797	5,367	844	6,164	12.93	2,194	1,426	7,008
45. Ramanathapuram ...	1,519	86.83	14,088	615	1,885	11,588	2,500	24.60	1,934	1,740	14,088
46. Tuticorin ...	3,781	98.68	23,086	6,341	13,679	3,066	20,020	31.67	10,072	3,910	23,086
47. Tirunelveli ...	2,639	97.39	19,218	1,071	14,641	3,506	15,712	6.82	3,641	2,763	19,218
48. Palayamkottai ...	1,700	98.00	9,802	2,781	5,609	1,412	8,390	33.15	4,447	1,770	9,802

49. Melapalayam	...	693	100.0	5,320	214	4,767	339	4,981	4.30	907	731	5,320
50. Shencottah	...	541	90.76	1,488	182	818	488	1,000	18.20	673	712	1,488
51. Salem	...	11,979	99.84	54,042	4,631	47,080	2,331	51,711	8.96	16,591	11,993	54,042
52. Rasipuram	...	556	83.09	2,635	229	1,869	537	2,098	10.92	691	664	2,635
53.• Coimbatore	...	7,940	98.77	69,046	4,933	55,514	8,599	60,447	8.16	12,775	8,295	69,046
54. Erode	...	3,206	95.45	26,413	445	24,385	1,583	24,830	1.79	3,505	3,262	26,413
55. Tiruppur	...	2,712	99.82	11,836	308	10,413	1,115	10,721	2.87	3,015	2,821	11,836
56. Pollachi	...	3,512	100.0	10,265	1,186	8,422	657	9,608	12.34	3,698	2,512	10,265
57. Dharapuram	...	1,157	96.80	3,649	14	3,424	211	3,438	0.41	1,134	1,159	3,649
58. Udumalpet	...	1,177	100.0	3,887	932	2,636	319	3,568	26.12	2,109	1,194	3,887
59. Mettupalayam	...	1,440	98.54	6,461	510	5,080	871	5,590	9.12	1,929	1,516	6,461
60. Gobichettipalayam	...	887	100.0	2,617	319	1,982	316	2,301	13.86	1,206	981	2,617
61. Kurichi	...					Not received						
62. Ootacamund	...	1,831	100.0	5,665	670	4,120	875	4,790	13.99	2,501	1,831	5,665
63. Coonoor	...	729	98.49	4,070	177	3,099	794	3,276	5.40	895	940	4,070
64. Nagercoil	...	7,010	94.89	16,595	6,748	4,483	5,364	11,231	60.08	13,400	6,213	16,595
65. Colachel	...	531	100.0	2,922	2,442	310	170	2,752	88.74	2,973	531	2,922
66. Kuzhithurai	...	94	95.74	1,785	156	188	1,441	344	45.35	246	97	1,785
67. Padmanabhapuram	...	462	89.39	3,777	1,798	1,456	523	3,254	55.26	2,211	505	3,777
Grand Total	...	220,141	98.04	1,589,347	123,177	1,209,682	256,488	1,332,859	9.24	338,998	226,208	1,589,319

TABLE 11-8

Statistics of Vaccination in the non-Municipal Areas of Madras State for 1960

Serial Number and name of district (exclusive of Municipal Towns)	Mid-year estimated population for 1960	Total No. of persons vaccinated			Primary Vaccination							
						Successful						
		Males	Females	Total	Total No. of operations	0—1 Year	1—5 Years	5—10 Years	10 Yrs. & above	Total	Un-success-ful	Result un-known
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Chingleput ...	1,933,000	121,355	101,344	222,699	37,450	13,358	13,860	1,599	56	28,873	1,263	7,314
2. North Arcot ...	2,678,000	240,881	214,953	455,834	97,792	52,805	18,941	2,134	55	73,935	3,814	20,043
3. South Arcot ...	2,727,000	296,065	269,290	565,355	112,199	43,084	30,510	2,059	264	75,917	7,085	29,197
4. Salem ...	3,546,000	299,835	289,881	589,716	114,549	35,309	36,103	3,539	20	74,971	6,578	33,000
5. Coimbatore ...	2,961,000	257,090	197,704	454,794	112,919	37,030	40,451	6,603	182	84,266	4,224	24,429
6. The Nilgiris ...	326,000	33,081	32,812	65,893	11,619	3,704	4,712	849	159	9,424	445	1,750
7. Madurai ...	2,541,000	267,206	227,855	495,061	88,953	41,756	19,566	1,697	243	63,262	3,947	21,744
8. Tiruchirapalli ...	2,840,000	212,952	183,716	396,668	96,051	35,445	23,249	4,472	296	63,462	4,739	27,850
9. Thanjavur ...	2,945,000	230,540	205,260	435,800	88,794	25,717	26,654	4,737	367	57,475	6,423	24,896
10. Ramanathapuram ...	1,793,000	168,615	145,785	314,400	74,204	21,675	24,359	1,497	32	47,563	5,492	21,149
11. Tirunelveli ...	2,392,000	119,500	108,871	228,371	57,330	20,405	13,654	2,586	40	36,685	4,499	16,146
12. Kanyakumari ...	818,000	96,366	119,127	215,493	33,642	8,776	14,166	4,312	...	27,254	2,982	3,406
Total for Districts ...	27,500,000	2,343,486	2,096,598	4,440,084	925,502	339,064	266,225	36,084	1,714	643,087	51,491	230,924
Total for the Municipalities.	6,230,000	931,090	884,437	1,815,527	228,731	139,906	66,813	8,672	430	215,821	4,320	8,590
Poonamallee Health Unit ...	...	6,393	4,670	11,063	2,711	1,461	722	31	2	2,216	87	408
Railways ...	...	14,683	7,574	22,257	2,114	873	1,036	103	5	2,017	30	67
By Medical Subordinates & Port Health Officers ...	...	49,642	9,318	58,960	3,857	959	1,776	485	7	3,227	171	459
Total for the State ...	33,729,000	3,345,294	3,002,597	6,347,891	1,162,915	482,263	336,572	45,375	2,158	866,368	56,099	240,448

TABLE 11-8—(*Contd.*)

Statistics of Vaccination in the non-Municipal Areas of Madras State for 1960—(*Contd.*)

Serial Number and name of districts (exclusive of Municipal Towns)	Primary vaccination—(*Contd.*)		Revaccination							Total No. of persons vaccinated	
	No. of cases in which the results were known [Cols. (6)—(13)]	Percentage of successful cases in which the results were known [Cols. (11) ÷ (14)]	Total No. of operations	Successful of all ages	Un-successful	Result un-known	No. of cases in which the results were known [Cols. (16)—(19)]	Percentage of successful cases in which the results were known [Cols. (17)÷(20)]	Total No. of successful operations [Cols. (11) + (17)]	Primary vaccination	Re-vacci-nation
	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
1. Chingleput ...	30,136	95.80	184,383	16,356	95,570	72,457	111,926	14.61	45,229	38,536	184,163
2. North Arcot ...	77,749	95.09	358,777	33,726	198,657	126,394	232,383	14.51	107,661	97,057	358,777
3. South Arcot ...	83,002	91.46	454,296	28,529	244,770	180,997	273,299	10.44	104,446	111,059	454,296
4. Salem ...	81,549	91.93	475,340	31,752	244,094	199,494	275,846	11.51	106,723	114,376	475,340
5. Coimbatore ...	88,490	95.23	342,076	28,785	183,727	129,614	212,462	13.52	113,001	112,718	342,076
6. The Nilgiris ...	9,869	95.49	54,274	5,073	38,736	10,465	43,809	11.58	14,497	11,619	54,274
7. Madurai ...	67,209	94.13	408,713	32,749	229,955	146,009	262,704	12.47	96,011	86,348	408,713
8. Tiruchirapalli ...	68,201	93.05	303,975	25,487	143,536	134,952	169,023	15.08	88,949	92,693	303,975
9. Thanjavur ...	63,898	88.38	348,292	19,017	190,694	138,581	209,711	9.07	76,492	87,508	348,292
10. Ramanathapuram ...	53,055	89.65	241,784	26,419	120,545	94,820	146,964	17.98	73,982	72,616	241,784
11. Tirunelveli ...	41,184	89.08	176,521	9,184	91,699	75,638	100,883	9.10	45,869	51,850	176,521
12. Kanyakumari ...	30,236	90.14	183,613	18,991	117,831	46,791	136,822	13.88	46,245	32,422	183,071
Total for Districts ...	694,578	92.59	3,532,044	276,018	1,899,814	1,356,212	2,175,832	12.69	919,105	908,802	3,531,282
Total for Municipalities ...	220,141	98.04	1,589,347	123,177	1,209,682	256,488	1,332,859	9.24	338,998	226,208	1,589,319
Poonamallee Health Unit ...	2,303	99.22	8,423	1,023	5,257	2,143	6,280	16.27	3,239	2,640	8,423
Railways ...	2,047	98.53	20,143	3,420	14,635	2,088	18,055	18.94	5,437	2,114	20,143
By Medical Subordinates and Port Health Officers ...	3,398	94.97	55,121	29,220	19,985	5,916	49,205	59.38	32,447	3,840	55,120
Total for the State ...	922,467	93.92	5,205,078	432,858	3,149,373	1,622,847	3,582,231	12.08	1,299,226	1,143,604	5,204,287

The First World War gave an impetus to cholera immunisation and the process is now in the forefront of anti-cholera measures. The International Sanitary Conference which has drawn up the new International Sanitary Convention of 1926, has embodied in that draft the following article:

" Since anti-cholera vaccination is a method of proved efficacy in staying cholera epidemics, and consequently in lessening the likelihood of the spread of the disease, sanitary administrations are recommended to employ, in the largest measure possible and so and often as practicable specific vaccination in cholera foyers and to grant special advantages as regards restrictive measures to persons who elect to be vaccinated." A higher degree of protection is obtained by giving two or even three separate and increasing doses of the vaccine. Large scale inoculations are conducted on the single dose principle, 1 c.c. of the vaccine to each adult male and proportionately smaller doses to females and children. Anti-cholera inoculation, unfortunately, immunizes for a very short period only and this period has been variously estimated at 3 to 9 months. The immunity will carry the protected individual over one cholera season. Inoculation campaigns are hence organized only prior to or during the period when cholera may be expected to break out.

The incidence of Cholera in the State has declined considerably during the last decade. There were only 20 deaths due to cholera in 1960 as against 26,432 in 1950. During 1960, anti-cholera inoculations were carried out in the affected and adjoining areas and the infection was brought under control. In other areas, although there was no cholera infection, anticipatory anti-cholera inoculations were carried out among those living in slums, labourers residing in villages alongside rivers and channels and other susceptible groups of population in the deltaic and endemic areas. A total of 312,675 anti-cholera inoculations were done in 1960 and compared to 1961 population the inoculation rate works out to 9.3 per 1,000. Considering the poor immunity period (of less than an year) of cholera inoculation, this rate of 9.3 is too low. There is need for a vigorous drive for educating the people on the need for cholera vaccination, if our object is to totally banish cholera. Since cholera is mainly a water-borne disease the improvement of water supply and drainage is bound to reflect itself in a reduction of cholera incidence.

The particulars of inoculations against cholera in the State during 1956 to 1961 are given in Table 11-9.

TABLE 11-9

Particulars of Inoculations against Cholera

District	Number of inoculations made in					
	1956	1957	1958	1959	1960	1961
Madras ...	47,385	286,500	26,928	21,893	7,648	4,666
Chingleput ...	69	12,689	3,061	10,128	2,126	6,176
North Arcot ...	10,043	107,547	120,660	70,616	112,998	31,688
South Arcot ...	4,067	21,416	206,615	16,306	23,686	31,190
Salem ...	5,150	82,299	182,023	12,038	23,500	42,769
Coimbatore ...	133,188	188,944	286,797	102,720	90,556	36,180
The Nilgiris ...	706	406	221	1,873	438	396
Madurai ...	7,729	265,467	639,005	85,846	85,620	14,161
Tiruchirapalli ...	185,733	436,720	68,930	26,181	15,237	108,096
Thanjavur ...	29,489	481,010	434,447	17,987	75,207	198,719
Ramanathapuram ...	47,375	12,873	116,149	9,491	46,466	15,590
Tirunelveli ...	11,208	218,562	209,009	12,839	13,600	6,935
Kanyakumari ...	262	2,456	9,797	1,037	10,821	5,976
State ...	482,404	2,116,889	2,303,642	389,155	507,903	502,542

B.C.G. Vaccination

The mass B.C.G. Vaccination campaign was inaugurated at Coimbatore in 1954. All district headquarter stations and their belt areas upto a radius of 5-6 miles were taken up first. After completion of the first phase of the campaign in all the district headquarter towns during 1955, the campaign then started on a district by district basis. During the first round of the programme, all the districts except Chingleput were covered. The total tuberculin tested and B.C.G. vaccinated during the first round upto the end of 1961 were 5,406,871 and 1,740,912 persons respectively. During the Second Plan period alone 32 lakhs of people were tested under this scheme and two units were run. The B.C.G. vaccination campaign commenced its second round from April 1961 in the districts of Coimbatore and Salem. The B.C.G. vaccination units comprising 10 teams are functioning in the State. The unit completed the work in Salem district and has started the work in South Arcot and Coimbatore districts. So far, 1,513,114 persons were tuberculin-tested and 401,369 persons were B.C.G. vaccinated in the second round upto the end of June 1962. The campaign will be continued and a provision of Rs. 14 lakhs has been made in the Third Plan and the programme is expected to cover about 79 lakhs of population.

Food and nutrition

The importance of food and nutrition in the maintenance of health and physical fitness needs no special emphasis. The nutrition of any community or group of people depends on the quality and quantity of food its members consume. Production of nutritive food depends on innumerable factors like climate, soil, etc., and safeguards are indispensable at every stage to enable unadulterated food supply. It is in the interests of public health that nutrition and diet surveys are conducted, and nutrition laboratories are established. The overall production of food, the method of storage, manner of cooking all go to influence public health. A balanced diet containing several nutritive ingredients tones up strength besides resisting diseases.

Dietary habits vary from place to place and this essentially determines the resistance power against diseases. In Madras State, cereals form the important food item and rice and millets are common. Only a small quantity of wheat is consumed. Rice has become

TABLE 11-10

Geographical Distribution of Principal Crops in 1960-1961
(*In* 1,000 *Acres*)

District		Cereals	Pulses	Sugarcane	Fruits and Vegetables	Condiments and spices	Cotton	Edible and non-edible oil seeds
Chingleput	...	953	13	3	23	7	...	127
South Arcot	...	1,156	44	34	53	11	7	370
North Arcot	...	1,001	89	39	22	8	1	471
Salem	...	1,494	302	23	55	21	62	337
Coimbatore	...	1,124	220	43	21	30	288	368
Tiruchirapalli	...	1,357	81	26	62	66	19	336
Thanjavur	...	1,533	82	9	38	8	...	100
Madurai	...	975	65	13	60	36	120	301
Ramanathapuram	...	1,008	47	8	11	56	215	127
Tirunelveli	...	782	100	1	28	62	266	74
The Nilgiris	...	18	1	...	28	1	...	...
Kanyakumari	...	152	9	...	62	5	1	30

staple food of the people in the State. Table 11-10 shows the geographical distribution of principal crops in Madras State during 1960-61.

Food adulteration, malnutrition, etc.

The need for a continuous supply of unadulterated food to the people can hardly be questioned. The provisions of the Central Prevention of Food Adulteration Act, 1954 have been implemented in this State from 1955. Under this Act, 247 local bodies (Municipalities and Panchayats and the Madras Corporation) are taking food samples towards checking adulteration of foodstuffs. On the average, about 2,500 samples are received in a month for analysis by the Government Analyst, King Institute, Guindy and the Madras Corporation Public Analyst. The percentage of adulterated samples was 25% during 1961. In order to completely eradicate the evil of adulteration of foodstuffs, it is proposed to undertake large scale sampling throughout the State with necessary improved laboratory facilities for food analysis. Table 11-11 gives a comparative picture of the average actual intake in Madras State and the recommended balanced diet.*

TABLE 11-11

Average consumption per consumption unit in households

Food items		Present consumption	Balanced Diet
		Quantity (in ozs.)	Quantity (in ozs.)
1. Cereals	...	20.4	14.0
2. Pulses	...	1.3	3.0
3. Vegetables	...	2.8	10.0
4. Fruits	...	2.0	3.0
5. Milk	...	2.4	10.0
6. Sugar & Jaggery	...	1.8	2.0
7. Vegetable oil, ghee, etc.	...	0.4	2.0
8. Fish/meat	...	0.6	3.0
9. Egg (in No.)	...	...	1
10. Approximate calorific value	...	2,500	2,700

Nutrition relief measures are made by way of milk distribution to children and the parturient mothers, supply of meals to children, etc. Milk contains calcium and protein of superior quality with all amino acids and it is the only nutritive which is easily spoiled and contaminated. Under the long-range scheme of distribution of skim milk implemented in Madras State with the UNICEF assistance, about 75,000 malnourished children and expectant and nursing mothers are receiving 8 ounces of liquid milk daily through about 1,700 centres *viz.*, Maternal and Child Health Centres, Primary Health Centres, hospitals and deserving voluntary agencies. This scheme is one of the major nutrition programmes undertaken in this State towards improving the health conditions of mothers and children. During 1960, about 50,000 mothers and infants were supplied with skim milk under the UNICEF milk feeding programme. As part of the Nutrition Relief Measures, multi-vitamin tablets and other supplements are distributed to the needy children and during 1960, 50 lbs. of shark liver oil, 6,900 calcium lactate tablets, 4,300 Fersolate tablets, 2,400 yeast tablets, 3,900 vitamin 'B' complex tablets and 1,000 multi-vitamin tablets were distributed.[1]

Hotel sanitation is very important from the public health point of view and hotels are visited by Health Officers to see whether the recommendations of the Hotel Sanitation Committee regarding the up-keep and maintenance of hygienic principles were being implemented. Owners are prosecuted for defects noticed like failure to provide sterilising sets, fly and dust proof covers, use of improperly tinned vessels, etc. To see that persons with infectious diseases are not employed in hotels, employees are examined at the time of appointment and subsequently also once a year by the Medical or Health Officers in accordance with the Catering Establishment Rules, 1959.

Madras State was the first State to begin mid-day meals scheme to children in the school. As on June 1960, the scheme was in operation in 23,455 schools and the beneficiaries were 794,372. Besides, the Harijan Welfare Department provided free mid-day meals to the children of eligible communities attending 870 schools. In Madras City, 28,700 children attending 278 elementary schools under Madras Corporation were given free mid-day meals. The school lunch programme was in operation in 508 primary schools in Kanyakumari district. Five hundred and thirty-one secondary schools in this State were also providing free mid-day meals to 16,700 students on a voluntary basis.

* *Source:* "Food habits in Madras State" of the Census Organisation (1964), p. 62.
[1] *Source:* Report on Health conditions in Madras State, 1960—Government of Madras (1963), pp. 50-58.

Housing

The influence of housing conditions on public health is unquestionable. Better housing conditions with sufficient rooms and good ventilation go to improve the health of individuals. Overcrowding, house-sharing, lack of household amenities are severe handicaps to physical and mental health. The pace of industrialisation with its attendant disadvantages of heavy concentration in urban areas, growth of slums and overcrowding of houses constitute a serious menace to public health. Several families in major cities live in slums where all the hall-marks of a healthy home are lacking.

Industrialisation has also contributed to the congestion in the cities. More and more families are migrating to urban areas in search of better life and they contribute to the housing problem. Yet, the paradox of the modern world has been a decline in housing standards, in spite of scientific understanding of the requirements of sound physical and mental health. Increase in numbers of people and the world-wide demand for town living have become great obstacles to a healthy life. As families get smaller and split into larger numbers of household units, the difficulties increase. Lack of privacy leads to less rigid forms of child discipline. But, as privacy becomes more valued for its own sake, the single room house, which is all that is available in so many countries is sadly wanting.* Even though the solution to the problem of family housing may vary from Japan to Jamaica, the fundamentals of hygienic living are the same. The single room units of a family compound in Bali have the same need as elsewhere for light and air, for kitchen amenities, for pure water and sanitation; and those of Japan with their paper partitions must contend with the same frustrations as the one-family rooms of Moscow or the overcrowded two-up-two-down in New Castle upon Tyne.[1] In 1951, Britain, after 6 million new houses had been built in 30 years, had 3 million households, holding 13½ million people, living at an average of more than one person per room—the maximum for healthy living prescribed by the Royal Commission on population; nearly 60,000 households lived at more than 3 per room. Over 2 million dwellings were shared between two families, including the high proportion, upto 75% in one city.

A crude measure of congestion of population is density of population per square mile. The average density of population per square mile in the State is 672 in 1961. The density in rural and urban areas are 513 and 4,459 respectively. Table 11-12 gives the district-wise details of the density of population and number of persons per house. The urban density is the highest in Madras City with 35,339 persons per square mile. The other districts which have a high urban density are Kanyakumari, Madurai, North Arcot, Salem and Thanjavur districts. Nilgiris district has the lowest urban density with 679 persons per square mile followed by Coimbatore and Tirunelveli districts.

A more refined index of housing conditions is the density per house worked out by dividing the population by the number of occupied residential houses (Vide Table 11-12). While the number of persons per house in all the districts generally ranges between 4 and 6, it is the highest in Madras City with about 12 persons per house. Tirunelveli district has the lowest number of persons per house (4.6). The number of persons per house in the urban areas is higher compared with that in rural areas. Besides Madras City, the districts of Chingleput, North Arcot and Madurai have congested urban areas. Tirunelveli, Nilgiris and Ramanathapuram districts are comparatively better placed in respect of urban housing. There is nothing significant to note in respect of housing in rural areas of districts. The number of persons per house varies from 4.5 in Tirunelveli district to 5.7 in North Arcot district. The rural-urban difference in density per house is highest in the case of Madurai district.

Another index of housing conditions can be thought of in terms of the number of rooms occupied by the households. As pointed out earlier, under ideal conditions, each household should have a drawing room, a kitchen, a bed-room, a bath-room and a water closet. These are the indispensable minima for a decent house. That the actual conditions in this State fall far short of this ideal can be seen from an analysis of the statistics of housing available for the State. The 1961 Census has elicited information on the conditions of housing including the number of rooms in occupied residential houses and the data have been tabulated on 20% sample basis. According to the Census definition, a room should usually have four walls with a door-way with a roof overhead and should be of at least 5 feet length. Unenclosed verandas, kitchen, store-room, garage, cattle-shed and latrine were not treated as rooms.

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* *Source:* World Health—Fraser Brockington, Pelican (1958), p. 88.

[1] *Source:* World Health—Fraser Brockington, Pelican (1958), pp. 92-93.

TABLE 11-12

Density of population and number of persons per house in rural and urban areas

District		Density of population per square mile		Number of persons per house in urban areas	Number of persons per house in rural areas	Number of persons per house in all areas
		Urban	Rural			
Madras	...	35,339	...	11.7	...	11.7
Chingleput	...	3,695	574	6.5	5.1	5.4
North Arcot	...	5,793	549	7.0	5.7	5.9
South Arcot	...	3,645	648	5.8	5.1	5.2
Salem	...	5,462	459	5.6	5.0	5.1
Coimbatore	...	2,905	445	6.0	5.1	5.3
Nilgiris	...	679	320	5.1	4.9	5.0
Madurai	...	6,517	466	6.9	5.1	5.6
Tiruchirapalli	...	4,044	471	5.4	4.7	4.8
Thanjavur	...	5,108	716	5.6	4.7	4.9
Ramanathapuram	...	4,409	388	5.1	4.7	4.8
Tirunelveli	...	2,913	457	4.8	4.5	4.6
Kanyakumari	...	10,599	1,341	5.9	5.5	5.6
State	...	4,459	513	6.4	5.0	5.3

Based on this 20 per cent sample tabulation, the percentages of households with two rooms and below to total households are worked out and presented in Table 11-14 for rural and urban areas. The percentage of population living in such houses is also given in the same table.

The rural-urban differential is quite striking. The percentage of households with less than two rooms is higher in rural areas in all districts except the Nilgiris district. In the Nilgiris district, the rural areas have a large number of houses with three and more rooms and this explains the better housing facilities in the rural areas of the Nilgiris district. Further, the percentage of houses without any regular rooms is nearly four times in the rural areas than in urban areas as may be seen from Table 11-13.

TABLE 11-13

Percentage of households with one room and below in Rural and Urban Areas

Areas			Percentage of households without any regular rooms	Percentage of households with one room
Rural	...	...	4.67	67.56
Urban	...	...	1.17	59.67
All areas	...	...	3.79	65.58

TABLE 11-14

Percentages of households with two rooms and below and the people living in them

(Based on 20% Sample)

District	Total Rural Urban	Percentage of households with two rooms and below to total house-holds	Percentage of people living in houses with two rooms and below to total population
1. Madras City ...	T	84.87	77.21
	R	...	...
	U	84.87	77.21
2. Chingleput ...	T	87.96	83.45
	R	90.10	86.68
	U	79.44	70.97
3. North Arcot ...	T	87.42	82.91
	R	89.57	85.72
	U	77.75	70.93
4. South Arcot ...	T	90.78	88.63
	R	91.72	89.85
	U	83.66	79.52
5. Salem ...	T	90.65	87.61
	R	92.07	89.78
	U	82.56	76.23
6. Coimbatore ...	T	89.24	85.73
	R	91.15	88.38
	U	84.15	79.02
7. Nilgiris ...	T	70.24	63.13
	R	67.88	60.91
	U	73.49	66.21
8. Madurai ...	T	89.56	85.35
	R	90.72	87.65
	U	86.87	80.35
9. Tiruchirapalli ...	T	90.59	88.02
	R	92.10	90.45
	U	84.32	78.52
10. Thanjavur ...	T	93.09	90.61
	R	94.56	92.90
	U	86.71	81.28
11. Ramanathapuram .	T	88.44	86.02
	R	89.68	88.05
	U	84.53	79.70
12. Tirunelveli ...	T	81.52	77.96
	R	84.43	81.47
	U	74.74	69.90
13. Kanyakumari ...	T	64.74	59.69
	R	65.07	60.11
	U	62.79	57.21
State ...	T	88.04	84.38
	R	89.88	87.18
	U	82.55	76.38

Source: Census of India, 1961—Vol. IX—Madras-Part IV-B Housing and Establishment Tables—E-V-Table.

The worst affected district in respect of housing is the Thanjavur district, where the percentage of households with two rooms and below is the highest recorded by any district (93.1). At the other end of the scale stands the Kanyakumari district with only 64.7%. Nilgiris comes next with 70.24%. A comparison of the percentage of people living in houses with less than two rooms confirms the above picture.

The bulk of investment on housing has necessarily to be in the private sector. The State Housing Board in Madras was constituted during the Second Plan period to co-ordinate the activities of various housing agencies besides undertaking large-scale housing programmes. During the Second Plan, a programme of slum improvement-*cum*-clearance was started in Madras City at a cost of Rs. 1.26 crores. Under this programme, 478 new tenements and 1,546 developed plots were made available. Under the subsidized industrial housing scheme, 1,377 houses were completed and 239 houses were under construction at a cost of Rs. 1.06 crores. Under the Low Income Group Housing Scheme, 3,160 houses were completed and 467 house-sites were provided at a cost of Rs. 2.83 crores. The Middle Income Group Housing Scheme for which funds are advanced by the Life Insurance Corporation of India helped to complete 120 houses, and 400 houses were under construction at the end of 1960-61. The Police Housing Scheme has made considerable progress during the plan period, though this scheme is not included in the plan itself. Nearly 4,200 houses came up under this scheme during the plan period at a cost of Rs. 26 lakhs.[1] The City Improvement Trust established in 1945 in Madras is also receiving loans and grants from Government for building houses in the City. The Madras Corporation and other local bodies have also undertaken modest housing schemes with Government assistance. During the Second Plan, the Low Income Group Housing Scheme and the Slum Clearance Schemes were implemented on an intensive scale. During the Third Plan, the outlay on housing for Madras State is Rs. 10.20 crores and the following schemes have been proposed:

(1) Bulk acquisition and land development;

(2) Subsidized Industrial Housing Scheme;

(3) Low Income Group Housing Scheme;

(4) Plantation Labour Housing Scheme;

(5) Slum Clearance Scheme;

(6) Village Housing Projects Scheme.

Nearly 4,000 tenements are to be built under the Subsidized Industrial Housing Scheme. It is proposed

[1] *Source:* Third Five-Year Plan, Madras State (1960).

to build 2,900 houses under the Low Income Group Housing Scheme. The main strategy of the Slum Clearance Scheme lies in inducing the slum-dwellers to move over from congested slums to newly constructed tenements wherever possible or to open developed plots. As the slum dwellers cannot bear heavy expenditure, the tenements and the developed plots have to be heavily subsidised. The targets set for this scheme are 9,000 developed plots and 4,000 tenements. Further, special attention will be devoted to avert the growth of slums. The Village Housing Scheme is aimed to serve the rural areas through housing projects in selected villages. Under the State Co-operative Urban and Rural Housing Programmes, 2,100 houses are to be built during the next five years. Provision has been made for housing for Government employees and under appropriate heads for housing the teaching staff of engineering colleges, medical personnel in rural areas and for the staff working in the Community Development Projects.

Mental health

Though mental illness is more noticeable in developed countries, yet it cannot be pronounced that under-developed countries are free from it. Mental sub-normality is considered neither mainly nor entirely medical. The constitution of an Advisory Committee on Mental Health by the Government of India points to the growing importance of mental health services in programmes for the development of public health and medical facilities. Attention is due to be given towards preventive mental hygiene services. Rapid industrialisation, technological changes and the movement of population from rural to urban areas bring with them certain tensions and problems of maladjustment. Mental health education should form an important part of the health education programme. It is said that mental hygiene can be improved by counselling for simple personal and emotional problems, education of parents and teachers on sound principles of child upbringing, etc. Statistics of mental health, like several other statistics are woefully lacking in India and one cannot entirely overlook the limited evidences available to us in spite of their limitations. Hospital statistics cannot give a complete picture of the mental health in the State and yet they are worth something. Conceptions of mental health and its opposite mental ill-health are totally absent in the common man and therefore, enumerations in the past are confined to insanity and not mental ill-health. These are however the only information available to us and we have examined them in detail.

The mental hospital at Kilpauk in Madras City is the only one of its kind in the State of Madras. Table 11-15 shows the number of males and females suffering

TABLE 11-15

Age distribution of long-stay patients in Government Mental Hospital, Madras (as on 31-12-'61)

Age Group	Mental Disorders				Mental Deficiency			
	Males		Females		Males		Females	
	No.	Percentages	No.	Percentages	No.	Percentages	No.	Percentages
5 & below ...	1	0.05	...	...	1	0.62	...	...
6—10 ...	13	0.71	13	1.44	4	2.49	8	10.15
11—15 ...	32	1.74	24	2.66	17	10.56	12	15.08
16—25 ...	362	19.76	172	19.05	54	33.53	21	26.61
26—35 ...	587	32.03	266	29.46	41	25.47	12	15.21
36—45 ...	433	23.63	217	24.03	25	15.53	12	15.21
46—55 ...	263	14.35	132	14.62	11	6.83	10	12.68
56—65 ...	111	6.05	69	7.64	7	4.35	4	5.06
66—75 ...	25	1.36	8	0.88	1	0.62	...	...
76—85 ...	6	0.32	2	0.22	...	...	...	...
Total ...	1,833	100.00	903	100.00	161	100.00	79	100.00

***Note*: The figures furnished under mental disorder include those for mental deficiency also.**

from mental disorders and mental deficiency and their percentages. The table relates to long-stay patients only. Among people with mental disorder, people of the age group 26-35 are the worst affected forming roughly one-third of the total. Approximately 90% and 87% of the males and females suffering from mental disorders are in the ages 16 to 55. Nearly two-thirds of the persons suffering from mental disorders are males. In mental deficiency, persons between the ages 16-25 suffer most. In all, there are 240 long-stay patients suffering from mental deficiency, and the male sufferers are more than double that of the females.

Details regarding the persons admitted in the Mental Hospital during 1961 are given in Table 11-16. The number of admitted males are nearly double the number of the females. Over two-thirds of the admitted males are between the ages 16 to 35. Among females also, this age group predominates. No analysis of the causes of the mental ill-health in these age groups is possible as no data are available. Fresh admissions have been few in the other age groups. It is rather difficult to arrive at any precise conclusions on the disproportion among male and female mental patients. It may also be that more males get themselves admitted into the hospital, and females do not come forward for treatment of mental disorders.

TABLE 11-16

Age distribution of patients admitted in 1961 at the Government Mental Hospital, Madras

Age Group		Males		Females	
		No.	Percentage	No.	Percentage
5 and below	...	1	0.09	1	0.20
6—10	...	9	0.84	9	1.82
11—15	...	14	1.31	7	1.42
16—25	...	352	33.03	146	29.55
26—35	...	371	34.81	174	35.24
36—45	...	199	18.67	92	18.62
46—55	...	92	8.63	50	10.12
56—65	...	22	2.06	12	2.43
66—75	...	6	0.56	2	0.40
76—85	...	...	...	1	0.20
Total	...	1,066	100.00	494	100.00

Table 11-17 gives details on the length of stay of persons in the mental hospital. It is noticed that over 30% among both male and female patients undergo treatment for one to four years. People staying between 4 and 7 years are nearly 15%. Roughly 28% among males and 33% among females remain in the Mental Hospital for less than an year. The remaining percentage of patients stay mostly between 7 and 25 years. People staying beyond 25 years are small in number and there are 72 males and 17 females in this group. The average duration of stay for males and females are 5.35 and 4.92 years respectively.

TABLE 11-17

Statistics of Length of Stay of Patients in Government Mental Hospital, Madras

(For patients remaining as on 31-12-'61)

Duration of stay		Males		Females	
		No.	Percentage	No.	Percentage
Under 1 Month	...	92	5.02	39	4.32
1— 2 Months	...	66	3.60	35	3.88
2— 3 do.	...	50	2.73	26	2.87
3— 6 do.	...	123	6.71	91	10.08
6— 12 do.	...	182	9.93	103	11.41
1— 4 Years	...	556	30.33	286	31.68
4— 7 do.	...	276	15.06	136	15.06
7— 10 do.	...	118	6.44	48	5.32
10— 13 do.	...	99	5.40	38	4.21
13— 16 do.	...	71	3.87	35	3.88
16— 19 do.	...	56	3.06	18	1.99
19— 22 do.	...	34	1.85	17	1.88
22— 25 do.	...	38	2.07	14	1.55
25— 28 do.	...	22	1.20	3	0.33
28— 31 do.	...	25	1.36	9	0.99
31— 34 do.	...	13	0.71	3	0.33
34— 37 do.	...	7	0.38	2	0.22
37— 40 do.	...	3	0.17	...	...
40— 43 do.	...	...	...	...	...
43— 46 do.	...	...	...	...	...
46— 49 do.	...	2	0.11	...	...
Total	...	1,833	100.00	903	100.00

Table 11-18 shows the diagnostic distribution of patients admitted in the hospital during 1961. Nearly 75% among males and 66% among females suffer from 'Schizophrenia disorder.' The other important disorders are Manic-Depressive Psychosis, Senile Psychosis, Psychosis of other demonstrable etiology, other unspecified Psychosis and mental deficiency. It is noticed that a greater percentage of females than males suffer from

Senile Psychosis. While there are 9 female sufferers in the group 'Psychosis with cerebral arterioscelerous,' there is no male sufferer in that group.

TABLE 11-18

Diagnostic distribution of patients admitted in 1961 at the Government Mental Hospital, Madras

	Males		Females	
	No.	Percentage	No.	Percentage
1. Schizophrenic disorder ...	797	74.77	324	65.59
2. Manic-Depressive Psychosis.	98	9.20	35	7.09
3. Involutional Melancholia ...	3	0.28	2	0.40
4. Paranota & paranoid states..	7	0.66	8	1.62
5. Senile Psychosis ...	11	1.03	25	5.06
6. Presenile Psychosis ...	1	0.09	7	1.42
7. Psychosis with Cerebral arterioscelerous ...	...	...	9	1.82
8. Alcholic Psychosis ...	...	...	...	...
9. Psychosis of other demonstrable etiology ...	75	7.04	46	9.31
10. Other and unspecified Psychosis ...	37	3.47	22	4.46
11. Anxiety reaction without mention of somatic symptoms ...	...	...	...	...
12. Hysterical reaction without anxiety reaction ...	1	0.09	...	...
13. Neurotic depressive reaction ...	1	0.09	...	...
14. Pathological personality ...	1	0.09	...	...
15. Other drug addiction ...	...	...	1	0.20
16. Primary Childhood behaviour disorders ...	...	...	...	...
17. Mental deficiency ...	19	1.79	13	2.63
18. Other and unspecified character, behaviour and intelligence disorder ...	...	...	...	...
19. No appreciable disease ...	14	1.31	2	0.40
20. Not yet diagnosed ...	1	0.09	...	...
Total ...	1,066	100.00	494	100.00

Statistics regarding Insanity, 1901-31

Insanity is a social rather than a medical term and the difference between sanity and insanity is largely a question of environment. Madness is a relative term and it is very difficult to ascertain accurate information on insanes. Data on insanes have been collected till the 1931 Census. Question on infirmity was included in the individual slip. The number of insanes, district-wise in Madras State and their rate per lakh of population are given for the Censuses from 1901 to 1931 in Tables 11-19 and 11-20. No clear-cut definition of insanity was given in these enumerations. Yeatts has observed in the 1931 Census report: ". . . it is very doubtful whether the figures collected at the Census are of any value at all as an absolute record. Experts differ on most things, but on few have they differed more often or more obstinately than on insanity in itself or in its particular manifestations. To expect therefore that a Census enumerator's idea of insanity is of any precise value is to cherish an illusion."[1] It is hence with a certain amount of reservation that we have to view the data on insanity. No close relative boldly reveals that a person is insane and the enumerator's task in recording them had remained a difficult affair throughout.

It may be seen from the table that insanity rate has gradually increased since 1901 and if this trend has continued we should be having a very high rate of insanity at present. The Census enumerations have also confirmed the picture obtained earlier *viz.*, insanity is more prevalent among males than among females. In 1931, there were 33 mentally deficient persons in a lakh of the State's population and the rate for the males was 41 as against 26 for the females. Madras City had the largest number of insanes throughout and during 1931, it had 178 insane persons for every lakh of population. Due to the existence of the Mental Hospital, more insanes might have migrated to Madras for treatment and this is probably responsible for the inflation of the figures for Madras City. As in 1931 Census, one out of every six insanes in Madras State lived in Madras City. Next to Madras, Kanyakumari and Tirunelveli districts had the largest number of insanes in 1931. Nilgiris, Chingleput and Salem districts had fewer insanes in a lakh of population. In the absence of comparable data for 1941, 1951 and 1961, it is difficult to arrive at any precise conclusions regarding the trend since 1931. The low insanity rate in Nilgiris district is rather striking and it is for the medical experts to assess how far the salubrity of the climate and the

[1] 1931 Census—Part I Report, Madras Presidency, p. 171.

low industrialisation go to contribute to this low rate of insanity. It will be highly useful if a survey can be conducted to assess the influence of geographical and environmental factors on mental health.

Mental illness is now regarded as a developmental ailment, one characteristic of an industrially advanced civilisation. For instance, there are nearly 520 mentally ill persons in the U.S.A. in every lakh of population and the figure is still higher in U.K. (560). Several factors like the fast tempo of life, the anxieties characteristic of an industrial society, lack of sufficient leisure, etc., could account for the high prevalence of mental illness in western countries. On the other hand, the slow tempo of life in under-developed countries where the drive for material advancement is less may well be more favourable to mental health. Further, meditation, the ritual of religion and security of the joint family may also have a bearing in checking mental ill-health.

Police Statistics

Accidents, murders, suicides and infanticides are in recent times traced to psychological or mental disorders and it is therefore useful to examine the statistics available to us from police records. Table 11-21 gives statistics on the deaths due to accidents, murders, suicides and infanticides during the decade 1951-60 as evidenced from police records. The number of accidental deaths during 1960 is 446 as against 151 during 1951. The number of deaths due to wounds and accidents in 1960 is 3,218 according to the ' Report on the Health conditions in Madras State,' 1960. The difference in the number is attributable to the non-inclusion in the police records of deaths due to domestic accidents, industrial accidents, etc. There has been an increasing trend in the number of deaths due to accidents during the decade. The high figure of 2,319 deaths in 1957 is surprising.

TABLE 11–19

Number of Insanes in Madras State in the Census Counts, 1901-31

District	1901			1911			1921			1931		
	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females
Madras City ...	517	386	131	693	501	192	750	541	209	1,305	971	334
Chingleput ...	115	60	55	196	115	81	252	149	103	275	154	121
North Arcot ...	252	165	87	388	218	170	431	248	183	653	359	294
South Arcot ...	284	158	126	290	152	138	307	142	165	512	288	224
Salem ...	312	167	145	272	140	132	263	163	100	465	268	197
Coimbatore ...	225	120	105	258	119	139	255	152	103	476	283	193
Nilgiris ...	19	9	10	20	10	10	16	9	7	20	15	5
Madurai ...	246	145	101	304	181	123	331	203	128	567	349	218
Tiruchirapalli ...	334	184	150	413	234	179	429	244	185	705	408	297
Thanjavur ...	298	177	121	354	197	157	331	192	139	627	368	259
Ramanathapuram ...	232	131	101	306	184	122	278	161	117	634	364	270
Tirunelveli ...	314	175	139	467	267	200	348	217	131	839	487	352
Kanyakumari ...	61	25	36	72	30	42	430	281	149	746	452	294
State ...	3,209	1,902	1,307	4,033	2,348	1,685	4,421	2,702	1,719	7,824	4,766	3,058

TABLE 11-20

Number of Insanes per 100,000 of population in Madras State during 1901-31

District		1901			1911			1921			1931		
		Persons	Males	Females	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females
Madras	...	94	138	48	120	170	69	127	175	74	178	251	96
Chingleput	...	9	9	8	14	16	11	17	20	14	17	19	15
North Arcot	...	15	19	10	20	23	17	21	25	18	28	31	26
South Arcot	...	13	15	12	12	13	12	13	12	14	21	24	18
Salem	...	16	17	14	13	14	13	12	15	9	19	22	16
Coimbatore	...	12	13	11	13	12	14	12	15	10	20	24	16
Nilgiris	...	17	15	19	17	16	18	13	13	12	12	16	6
Madurai	...	14	17	12	16	19	13	17	21	13	26	32	20
Tiruchirapalli	...	16	18	14	18	22	15	18	21	16	30	36	25
Thanjavur	...	13	17	10	15	18	13	14	17	11	26	32	21
Ramanathapuram	...	15	18	12	18	23	14	16	20	13	34	41	28
Tirunelveli	...	19	21	16	26	30	21	18	23	13	40	48	33
Kanyakumari	...	17	14	20	17	14	20	87	113	61	128	155	101
State	...	17	20	13	19	23	16	20	25	16	33	41	26

Another point worthy of notice is that Madras City accounts for comparatively lesser number of deaths as a consequence of accidents. Coimbatore and Tiruchirapalli account for a fairly larger number of deaths. During 1960, we find that Madurai, Chingleput, Tiruchirapalli and Coimbatore have recorded larger number of deaths than the other districts.

The number of murders in the State is around 800 per annum. During the decade, the peak figure was in 1952 with 896 murders and the lowest was in 1960 with 717 murders. From an analysis of the position during all the 10 years it may be inferred that Salem and Coimbatore are the worst districts in this respect and they account for approximately one-third of the total number of murders in the State. Tirunelveli and Madurai are also areas with fairly large murders. Nilgiris and Kanyakumari districts and Madras City are not much affected by murders. Table 11-22 gives a causal analysis of murders for the past 10 years. A longitudinal analysis shows that all through the years, family disputes and sex matters have weighed much in murders. Murders due to family disputes have gone up considerably during the last 10 years. Murders due to robbery which formed 6.1% of the total murders in 1951 have gone down to 3.6% in 1961. Murders due to sexual matter form 22.9% in 1960. Murders due to factions have fluctuated widely and there were 67 murders out of faction during 1960.

TABLE 11-21

Statistics of deaths due to Accidents, Murders, Suicides and Infanticides from the Police Records, 1951-60

Districts	1951				1952			
	Accidental Deaths	Murders	No. of cases in which murderers committed suicide	Infanticide	Accidental Deaths	Murders	No. of cases in which murderers committed suicide	Infanticide
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1. Madras ...	...	18	...	...	...	28	...	...
2. Chingleput ...	9	35	...	1	20	37	...	1
3. North Arcot ...	36	34	1	3	19	46	3	1
4. South Arcot ...	17	44	1	...	21	55	...	2
5. Salem ...	19	143	12	...	16	158	5	...
6. Coimbatore ...	32	139	...	...	34	145	3	...
7. Nilgiris ...	4	8	...	...	3	8	2	4
8. Madurai ...	...	101	19	1	...	80	8	...
9. Tiruchirapalli ...	26	57	2	1	41	88	2	4
10. Thanjavur ...	...	52	1	...	1	61	1	...
11. Ramanathapuram ...	1	74	3	1	...	75	...	...
12. Tirunelveli ...	7	103	1	3	2	115	2	3
13. Kanyakumari ...	...	...	...	...	...	...	...	...
State ...	151	808	40	10	157	896	26	15

TABLE 11-21—(*Contd.*)

Statistics of deaths due to Accidents, Murders, Suicides and Infanticides from the Police Records, 1951-60—(*Contd.*)

Districts		1953				1954				1955			
		Accidental Deaths	Murders	No. of cases in which murderers committed suicide	Infanticide	Accidental Deaths	Murders	No. of cases in which murderers committed suicide	Infanticide	Accidental Deaths	Murders	No. of cases in which murderers committed suicide	Infanticide
		(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)
1. Madras	...	...	25	4	...	30	21	...	...	8	15	...	25
2. Chingleput	...	23	32	...	...	36	27	1	5	39	45	...	10
3. North Arcot	...	26	53	...	1	26	62	5	4	28	62	...	7
4. South Arcot	...	28	37	2	1	15	51	4	...	77	36	...	1
5. Salem	...	24	150	5	1	12	140	3	1	20	132	...	...
6. Coimbatore	...	20	149	14	2	27	122	6	...	26	120	...	...
7. Nilgiris	...	1	12	1	1	2	4	...	1	1	5	...	...
8. Madurai	...	...	89	15	1	...	97	6	1	2	98	6	...
9. Tiruchirapalli	...	44	79	3	7	36	59	1	2	...	64	...	1
10. Thanjavur	...	2	67	2	...	6	53	2	...	6	75	...	...
11. Ramanathapuram	...	...	60	...	...	...	50	...	2	19	56	...	3
12. Tirunelveli	...	...	137	...	2	...	103	...	3	1	101	...	3
13. Kanyakumari	...	...	...	...	...	...	...	...	...	...	...	...	...
State	...	168	890	46	16	190	789	28	19	227	809	6	50

TABLE 11-21—(*Contd.*)

Statistics of deaths due to Accidents, Murders, Suicides and Infanticides from the Police Records, 1951-60—(*Contd.*)

Districts	1956				1957			
	Acci-dental Deaths	Murders	No. of cases in which murderers committed suicide	Infan-ticide	Acci-dental Deaths	Murders	No. of cases in which murderers committed suicide	Infan-ticide
	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)
1. Madras ...	...	16	...	17	115	12	1	24
2. Chingleput ...	47	32	...	11	208	17	...	...
3. North Arcot ...	27	52	...	5	393	55	6	2
4. South Arcot ...	85	31	...	1	103	36	...	...
5. Salem ...	40	128	...	2	26	112	1	12
6. Coimbatore ...	38	133	15	3	456	108	19	...
7. Nilgiris ...	5	7	...	...	58	8	...	...
8. Madurai ...	19	100	14	...	161	82	12	...
9. Tiruchirapalli ...	35	53	...	1	718	75	7	2
10. Thanjavur ...	...	62	...	...	...	47	...	1
11. Ramanathapuram ...	4	53	...	3	24	68	...	3
12. Tirunelveli ...	...	82	...	1	1	92	3	5
13. Kanyakumari ...	3	16	...	...	56	7	1	...
State ...	303	765	29	44	2,319	719	50	49

TABLE 11-21—(Contd.)

Statistics of deaths due to Accidents, Murders, Suicides and Infanticides from the Police Records, 1951-60—(Contd.)

Districts	1958				1959				1960			
	Acci-dental Deaths	Mur-ders	No. of cases in which murderers committed suicide	Infan-ticide	Acci-dental Deaths	Mur-ders	No. of cases in which murderers committed suicide	Infan-ticide	Acci-dental Deaths	Mur-ders	No. of cases in which murderers committed suicide	Infan-ticide
	(30)	(31)	(32)	(33)	(34)	(35)	(36)	(37)	(38)	(39)	(40)	(41)
1. Madras ...	28	10	...	12	25	18	...	13	30	16	2	19
2. Chingleput ...	47	14	...	7	38	33	...	6	71	20	1	10
3. North Arcot ...	93	56	...	...	14	49	7	1	21	52	12	...
4. South Arcot ...	117	37	...	2	99	54	3	2	40	53	3	1
5. Salem ...	39	122	11	1	34	101	10	3	34	121	5	...
6. Coimbatore ...	50	120	8	...	33	118	6	2	55	111	10	8
7. Nilgiris ...	...	4	...	...	1	3	...	...	3	6	...	1
8. Madurai ...	39	91	...	1	40	104	16	2	80	74	9	1
9. Tiruchirapalli ...	49	67	1	3	59	68	3	1	64	58	2	4
10. Thanjavur ...	7	55	1	2	18	66	2	1	17	56	2	...
11. Ramanathapuram ...	25	73	...	3	8	51	...	...	29	55	...	...
12. Tirunelveli ...	...	88	...	4	2	83	...	2	2	86	...	2
13. Kanyakumari ...	...	18	...	2	...	13	1	...	...	9	1	...
State ...	491	755	21	37	371	761	48	33	446	717	47	46

TABLE 11–22

Deaths due to Murders in Madras State classified by causes as per Police Records, 1951-60

Year	Sexual matter		Family disputes		Faction		Robbery		Other causes		Total	
	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage	Number	Percentage
1951	170	21.0	183	22.6	62	7.7	49	6.1	344	42.6	808	100.0
1952	214	23.9	198	22.1	72	8.0	5	0.6	407	45.4	896	100.0
1953	156	17.5	220	24.7	62	7.0	5	0.6	447	50.2	890	100.0
1954	184	23.3	194	24.6	74	9.4	30	3.8	307	38.9	789	100.0
1955	192	23.7	180	22.3	77	9.5	30	3.7	330	40.8	809	100.0
1956	154	20.1	189	24.7	90	11.8	37	4.8	295	38.6	765	100.0
1957	128	17.8	242	33.7	86	12.0	18	2.5	245	34.0	719	100.0
1958	177	23.4	183	24.2	66	8.8	31	4.1	298	39.5	755	100.0
1959	181	23.8	197	25.9	72	9.5	31	4.1	280	36.7	761	100.0
1960	164	22.9	204	28.5	67	9.3	26	3.6	256	35.7	717	100.0

There is a good number among murderers, who commit suicide. In 1960, there were 47 suicides among murderers. Suicides among murderers account for 2.1% of the total suicides. If we presume that each murder is designed by one person, then, of the 717 murderers, 47 committed suicide thus forming 6.6%. There have been 2,253 suicides in the State during 1960, of which males account for 1,065 and females 1,188. More females commit suicide than males in rural areas. In the urban areas of the State male suicides are higher in number than female suicides. Table 11-23 shows the male and female suicides in rural and urban areas during 1960.

TABLE 11–23

Male and female suicides in rural and urban areas, 1960

Rural/Urban	Males	Females
Rural ...	814	951
Urban ...	251	237
Total ...	1,065	1,188

Table 11-24 shows the district-wise suicide figures for 1960.*

TABLE 11-24

Number of suicides in Madras State in 1960

District	Males	Females	Total
Madras ...	65	64	129
Chingleput ...	51	40	91
North Arcot ...	122	127	249
South Arcot ...	66	114	180
Salem ...	160	176	336
Coimbatore ...	135	146	281
Nilgiris ...	9	6	15
Madurai ...	100	130	230
Tiruchirapalli ...	103	96	199
Thanjavur ...	125	115	240
Ramanathapuram ...	35	49	84
Tirunelveli ...	62	112	174
Kanyakumari ...	32	13	45
State ...	1,065	1,188	2,253

* *Source:* Report on the Health Conditions in Madras State, 1960, Government of Madras (1963).

It may be seen from the above table that just as in the case of murders, in respect of suicides also Salem and Coimbatore districts lead the rest in the State. The districts of Kanyakumari, Nilgiris, Ramanathapuram and Chingleput are comparatively better. Roughly 60% of the suicides in the State occur in Salem, Coimbatore, North Arcot, Madurai and Thanjavur districts.

Deaths due to infanticides which were 10 in 1951 have risen to 46 in 1960. The number of deaths centre round 50 since 1955 and prior to that it had not touched even 20. A look at the figures since 1955 will show that Madras City and Chingleput district are more affected and the other areas are comparatively free from infanticide deaths.

Even though snake-bites are not the result of public health hazards yet it is not out of place to consider their havoc in rural and urban areas. Insanitary conditions do help in breeding venomous snakes. The rural areas, naturally, share the major percentage of deaths. During 1960, there were 942 deaths due to snake-bites and beasts in the State of which 809 were in rural areas and the remaining 133 in urban areas.

Industrial Hygiene

Industrialisation has brought in its wake several hygienic problems and the latter has grown along with the increase in the number and complexity of industries. Modern large scale industries signify the congregation of innumerable workers in a particular working place and the erection of complex and delicate machinery. For the safety of the machines as well as the men who operate them, precautionary measures are taken. The idea behind such measures is to prevent the occurrence of accidents and the spread of industrial diseases. Industrial hygiene, hence, consists in taking such measures to maintain the cleanliness in factories which will ultimately minimise the occurrence of accidents and spread of diseases.

The western countries experienced problems of industrial hygiene during the middle of the 19th century. The industrialisation in those countries led immediately to ugliness, squalour, insanitary dwellings, exploitation of wage earners, high mortality and spreading infections, loosening of family ties and morals and the employment of children under dangerous conditions. Such problems of the European countries have provided a lesson to the developing countries like ours and enables us to combine our plans for starting big industries with plans for the maintenance of industrial hygiene also. It is this realisation that has led planners to think of housing, water supply, power supply, sanitation, air-conditioning, medical facilities, etc., even while finalising plans to start industries. The distance that the residential areas should be away from the factories, adequate supply of water, fencing of dangerous machinery, sound building, proper lighting, all go to influence industrial hygiene. Industrial hygienic problems differ from one industry to another as, for example, between textile industries, rice mills, etc., and chemical and fertilizer industries. In cotton ginning factories, for example, there is always danger to workers on account of the number of belts and pulleys connecting the main line shaft, and the confined space in which the operator has to work. The tackling of hygienic problems in factories and the safety measures result in maintaining an optimum level of industrial production besides boosting the health of the industrial workers. It may also be said that industrial peace and industrial efficiency synchronize with industrial hygiene. Labourers working in factories for long hours under trying conditions become inefficient. They need protection against accidents causing their death or disability which may be either temporary or permanent and partial or complete. Let us see how far industrial legislation in India provides for health, safety and welfare of industrial workers.

Factory legislation in India was first made in 1881, (Factory Act of 1881) and it has been modified by several subsequent Acts. While certain conditions are enforced in factories by the Factory Act, the non-regulated factories and non-factory establishments are left scot free. The International Labour Office Report on Industrial Labour in India, says about Indian factories as follows: "There is a marked absence of adequate sanitary arrangements. In such industries as the manufacture of shellac, which is carried on in unsatisfactory buildings with leaking roofs, earth floors and poor lighting and ventilation, there is an almost universal absence of washing and sanitary arrangements. There is a similar lack of sanitary arrangements and drainage in tanneries where there are pools of filthy water and the earthern floors are littered with evil-smelling refuse."

The object of the various Factories Acts was to prevent the employment of children in the factories, to limit the hours of work of men, women and children, to enable them to have rest during the working hours and to make arrangements for their safety and comfort in the factories. The Factory Act of 1948 prescribes in detail the precautions to be taken for ensuring the health, safety and welfare of the workers. In addition to cleanliness, lighting, etc., provision has been made for the elimination of dust and fumes, provision of spittoons, control of temperature, supply of cool drinking water during summer and employment of cleaners.

to keep water closets clean. To avoid over-crowding, a minimum space of 500 and 350 cubic feet per worker has been prescribed for factories built after and before 1948 respectively. Precautions ensuring safety of workers have been provided for, and the responsibility for the safety of the workers is placed on the occupier of the factory. Under the Workmen's Compensation Act of 1923, a workman is entitled to compensation for incapacity due to employment injury, partial or total, temporary or permanent and death and also for certain industrial diseases, and the rates of compensation vary according to the loss of efficiency and earning capacity due to injury or disease. The Employees' State Insurance Act, 1948, provides for sickness, maternity, disablement, dependents' and medical benefits and it is administered by the Employees' State Insurance Corporation.

In Madras State, the Chief Inspector of Factories administers the Factory Act. Health Officers visit the factories periodically and report on their ventilation, lighting, over-crowding, water supply, etc., to the respective Inspectors of Factories who take further action under the Factories Act. Factory sanitation in Madras State is considered satisfactory and supply of wholesome water adequate and hygienic. Steps are also being taken to mitigate dust nuisance in textile and decorticating factories and to prevent inhalation of dust by employees. Dangerous parts of the machinery are fenced to prevent accidents. All factories are equipped with first-aid boxes or cup-boards. Most of the factories come under Employees' State Insurance Scheme and in respect of the other factories which do not come under the scheme, medical facilities to workers are provided. The idea is to give complete protection to the workers against industrial diseases. Housing of industrial workers is not satisfactory in the State. To ensure public health, industrial and residential areas are distinguished. Almost all the municipalities and a large number of panchayats have set apart industrial areas.

TABLE 11-25

Accident rates in factories of Madras State*

Year	No. of workers employed	Rate of accident per 1,000 workers	Total No. of accidents	Accidents analysed according to age and sex		
				Men	Women	Young persons
1	2	3	4	5	6	7
1950	391,457	16.5	6,465	6,334	119	12
1951	417,545	15.9	6,650	5,509	128	13
1952	400,379	17.0	6,856	6,713	120	23
1953	295,660	19.0	5,628	5,564	55	9
1954	321,859	17.7	6,014	5,930	77	7
1955	321,865	22.2	7,395	7,287	103	5
1956	293,606	34.9	10,530	10,436	90	4
1957	302,281	42.0	13,420	13,314	103	3
1958	308,368	51.9	16,571	16,484	87	...
1959	300,394	56.1	17,816	17,660	155	1
1960	286,176	52.1	16,680	16,563	117	...

*** The figures for 1950 to 1953 include areas of Andhra Pradesh which formed part of the composite Madras State. The figures for 1953 to 1956 include those of Malabar and South Kanara.**

TABLE 11–26

Number of Fatal and Non-Fatal Accidents Classified into Major Industries for the entire State of Madras

Classification	1950		1951		1952		1953		1954		1955		1956		1957		1958		1959		1960	
	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal	Fatal	Non-Fatal
01 ...	1	22	...	42	1	21	...	1	...	11	...	12	...	9	...	7	1	15	2	15	...	10
20 ...	8	668	7	1,154	20	1,103	3	718	7	700	8	720	1	604	6	607	3	976	2	520	4	361
21 ...	...	4	...	...	...	...	...	...	...	...	...	1	...	2	1	...	...	1	...	...	...	1
22 ...	2	193	...	179	2	140	...	1	...	1	...	1	...	4	...	1	...	9	...	3	...	2
23 ...	8	1,309	6	1,327	4	1,522	2	1,289	4	1,429	3	1,826	2	2,386	5	2,877	7	2,897	6	3,752	3	3,766
24 ...	...	1	...	1	...	2	...	...	...	...	...	...	...	1	...	1	...	1	...	3	...	5
25 ...	1	31	1	60	2	62	2	57	1	49	...	68	...	5	...	...	...	4	...	7	...	6
26 ...	...	17	...	24	...	12	...	7	...	10	...	46	...	12	...	40	...	49	...	60	...	46
27 ...	...	30	...	15	...	15	...	2	...	1	...	...	...	...	...	...	...	...	...	1	...	4
28 ...	...	50	...	48	...	61	1	95	...	116	1	115	...	103	...	77	...	121	...	206	...	163
29 ...	...	8	...	32	...	9	3	5	...	10	2	13	2	23	...	34	2	35	1	32	2	39
30 ...	...	4	...	2	...	1	...	3	...	4	...	16	...	16	...	19	...	30	...	121	...	182
31 ...	7	301	7	259	2	281	2	220	3	314	2	298	2	546	3	877	...	1,476	7	935	3	1,398
32 ...	1	102	...	126	...	103	...	40	...	76	...	97	...	194	...	192	...	229	...	240	...	299
33 ...	5	258	3	261	1	314	2	304	1	278	...	365	3	310	2	287	...	313	3	378	3	388
34 ...	...	45	...	26	...	86	1	66	...	44	...	31	...	60	1	48	...	78	1	140	1	175
35 ...	...	110	...	101	...	44	...	30	...	42	...	77	...	173	...	323	...	296	...	379	...	426
36 ...	2	123	...	125	1	351	1	372	1	537	1	755	2	1,462	2	1,655	3	1,731	...	1,952	...	1,713

37 ...	1	41	...	64	...	56	...	56	...	81	...	56	...	102	...	143	...	215	...	196	...	192
38 ...	...	2,821	2	2,517	3	2,402	2	2,080	...	2,025	1	2,633	2	4,223	4	5,907	3	7,722	4	8,421	3	7,094
39 ...	4	161	...	198	2	132	...	154	...	151	1	136	1	163	...	153	2	188	3	254	...	223
51 ...	...	72	2	53	1	78	...	94	...	98	3	77	...	94	4	89	2	116	...	109	...	117
52 ...	...	2	...	...	...	1	...	...	...	1	...	...	...	...	...	...	...	...	...	2	...	...
83 ...	2	7	...	7	1	12	...	12	...	13	2	21	...	20	1	51	...	44	4	51	...	47
84 ...	...	1	...	1	...	8	...	3	...	6	1	6	...	3	...	3	...	2	...	6	...	4
Total ...	42	6,381	28	6,622	40	6,816	19	5,609	17	5,997	25	7,370	15	10,515	29	13,391	23	16,548	33	17,783	19	16,661

01. Processes allied to agriculture (Gins and Presses).
20. Food except beverages.
21. Beverages.
22. Tobacco.
23. Textiles.
24. Footwear, other weaving apparel and made up textile goods.
25. Wood and cork except furniture.
26. Furniture and fixtures.
27. Paper and paper products.
28. Printing, publishing and allied industries.
29. Leather and Leather products (except footwear).
30. Rubber and Rubber products.
31. Chemical and Chemical products.
32. Products of petroleum and coal.
33. Non-metallic mineral products (except products of petroleum and coal).
34. Basic metal industries.
35. Metal products (except machinery and transport equipment).
36. Machinery (except electrical machinery).
37. Electrical machinery, apparatus, appliances and supplies.
38. Transport equipment.
39. Miscellaneous industries.
51. Electricity, gas and steam.
52. Water and sanitary services.
83. Recreation Services (Cinema Studios).
84. Personal services (Laundries, dyeing and cleaning.)

Normally, the residential areas are away from the industrial regions. The setting up of Industrial Estates and colonies with all amenities have also contributed in providing healthy living conditions for industrial workers.

Accidents, fatal or non-fatal, in industries are the most detestable, and steps are taken to avoid accidents. The risk of accidents varies from one industry to another. There are dangerous industries where the risk is high and others where there is no risk whatsoever and a greater precaution is essential in the former type than in the latter type. There are several factors which contribute to accidents in factories like carelessness on the part of the workers, machines of inferior quality, failure of the human element, unhealthy surroundings provided by the employer, etc. It is useful to analyse the statistics of accidents in Madras State during 1950-60.

It may be seen from Table 11-25 that the number of accidents has gone up substantially in recent times. The accident rate never touched 20 per 1,000 during 1950 to 1954. Since 1955, the rate has increased and it reached a high figure of 56.1 in 1959 and in 1960, the rate fell to 52.1. The steep increase in the number of industrial accidents is revealed by the fact that while in the composite Madras State which covered more factories, there were less than 7,000 accidents, we have to-day in the reorganised Madras State over 16,000 accidents. Roughly, 99% of the persons affected by industrial accidents are men. The number of accidents involving women every year is around 100 and the number involving children is practically nil. The latter may be the aftermath of the strict enforcement of the Factories Act which prohibits employment of young persons in dangerous jobs.

Table 11-26 shows the number of fatal and non-fatal accidents classified by major industries during 1950 to 1960. It may be seen that fatality rates among industrial accidents are not high in Madras State. During 1960 there were only 19 fatal cases among 16,680 accidents. A large proportion of these fatal accidents occur in food factories, textile mills, leather, chemical and metal industries and transport industries. Transport industries continue through the years to be the only industry where the largest number of accidents (roughly 43% of total accidents in 1960) occur. This is followed by textile industries which accounted for roughly 23% of the accidents in 1960.

The fatality rate is worked out as a ratio of fatal accidents to total accidents. The rate for all industries during 1956 to 1960 is found to be 2 per 1,000. Similar rates have also been worked out in respect of 13 selected industries which had more than 500 accidents during the five year period 1956-60.

TABLE 11-27

Fatality rates for 1,000 accidents during 1956-60 in respect of selected industries

Industry		Fatality Rate per 1,000
1. Food except beverages	...	5
2. Textiles	...	1
3. Printing, Publishing & Allied Industries	...	...
4. Chemical and Chemical products	...	3
5. Products of Petroleum and coal	...	...
6. Non-metallic mineral products (except products of petroleum and coal)	...	1
7. Basic metal industries	...	6
8. Metal products (except machinery & transport equipment)	...	...
9. Machinery (except electrical machinery)	...	1
10. Electrical machinery, apparatus, appliances and supplies	...	...
11. Transport equipment	...	...
12. Miscellaneous industries	...	6
13. Electricity, gas and steam	...	11
All Industries	...	2

The above analysis presented indicates that the largest fatality rate (11 per 1,000) has been recorded in the category 'Electricity, gas and steam.' The risk of accidents in this industry may therefore be regarded as high. The other industries which have high fatality rates are 'miscellaneous industries' (6 per 1,000) 'basic metal industries' (6 per 1,000) and 'Food except beverages' (5 per 1,000).

Table 11-28 gives data on accidents classified into eight causes. Next to 'miscellaneous' we find that the causes like 'striking by falling body', 'handling of goods', 'striking against objects' and 'power driven machinery' weigh more in bringing about industrial accidents in the State.

TABLE 11-28

Accidents Classified into eight Causation Groups

Year	Struck by falling body	Stepping on or striking against objects	Power driven machinery	Handling of goods	Use of hand tools	Persons falling	Molten metal or other hot or corrosive substances	Miscellaneous
	Accidents Classified under Causation Groups							
1950 ...	1,857	575	852	475	341	437	223	1,663
1951 ...	1,467	585	956	576	440	398	249	1,779
1952 ...	1,349	555	881	523	508	407	322	2,311
1953 ...	1,191	431	830	752	404	294	269	1,457
1954 ...	1,218	648	976	520	455	316	309	1,572
1955 ...	1,465	605	1,200	684	656	862	354	2,069
1956 ...	2,059	1,336	1,776	960	892	505	417	2,585
1957 ...	2,765	1,495	1,897	1,554	1,290	508	598	3,313
1958 ...	2,978	1,852	2,468	1,879	1,398	615	899	4,483
1959 ...	1,997	2,063	2,394	3,217	1,367	614	832	5,332
1960 ...	2,602	1,829	2,099	3,202	962	753	548	4,685

We have data on the accidents in establishments coming under the Workmen's Compensation Act of 1923. The fatality rates in respect of these establishments are given for 1957-61 in Table 11-29.

The figures show that the fatality rate during the five years is the highest with 64 per 1,000 accidents in the case of building and construction works. In respect of mines which constitute only a small proportion of the industries in the State the rate is quite high (13 per 1,000). The fatality rate for Factories is just 3 per 1,000 and it is apparent from this that the risk of accidents in factory establishments is not very high compared with other non-factory establishments. The fatality rate in respect of all establishments is found to be six per 1,000.

TABLE 11-29

Fatality rates per 1,000 accidents during 1957-61 in respect of establishments covered by the Workmen's Compensation Act

Establishments	Total No. of accidents	No. of fatal cases	Fatality rate per 1,000 accidents
Factories ...	34,497	106	3
Mines ...	2,106	27	13
Ports and Docks ...	2,959	10	3
Building and Construction ...	580	37	64
Plantations ...	2,367	30	13
Miscellaneous ...	6,175	99	16
Total ...	48,684	309	6

CHAPTER XII

INTERNATIONAL AND INTER-STATE MIGRATION

Basic concepts

Next to fertility and mortality, migration is an important factor contributing to the growth of population of a country. The study of migration has assumed considerable importance in recent times on account of the influx of refugees from Pakistan and also the process of inter-State and rural-urban migration that is taking place in India. Economic development and industrialisation of several areas have brought about a shift in population from one area to another and a study of such shifts is an essential requirement of proper planning. That international migration has little influence on the State's population growth will be evident from Table 12-2.

There are three main sources of data available for the study of migration. (1) Census population count as well as its age-sex break-up, (2) Tables showing the place of birth of population, and (3) Registration data. Each of these basic material suffers from several limitations in the context of migration study, but it is nevertheless impossible to dismiss them altogether. The best procedure under the existing circumstances is to attempt independent estimates of migration by different procedures and compare them with one another for whatever they are worth and draw our own independent conclusions from the materials available to us. In India, unlike in countries like Japan and Spain, the movement of population is not registered and therefore we have to place reliance on methods based on Census and vital registration data. Quite often the demographer who makes an analysis of the Vital Statistics and migration data cannot escape a circular reasoning since each one involves the other and an analysis of one is impossible without assumption regarding the accuracy of the other. When such is the case, there is the added difficulty caused by the need for adjustment for territorial changes in the past. During the 1951-61 decade, Madras State as constituted for Census purposes has undergone considerable changes on account of the reorganisation of States and consequently the available data were rendered useless for drawing inferences regarding the present Madras State. The Compiler Posting Statements of the Migration Tables of the 1951 Census had been destroyed and therefore the possibility of reconstructing the migration tables for the present Madras State from the earlier records had to be ruled out. Therefore, we were left with the general procedure of 'pro-rating' and one should keep in mind the limitations of this procedure while interpreting the data. However, the use of more refined approaches has been made wherever such approaches were feasible.

Growth Rate method of estimating migration

A crude indicator of internal migration in a country is the differential growth rates of different States. If we assume that the natural increase is the same in all States and that there is no international migration, the differences in the growth rates of India and Madras State indicate the rate of net migration.

Denoting by P_o. P_n the population of Madras State and P^1_o, P^1_n the population of India at two Censuses 10 years apart, then

$$P_n = P_o (1+r)^n$$
$$P^1_n = P^1_o (1+r^1)^n$$

Where r and r^1 are the growth rates for Madras and India respectively. The net migration during the decennium according to the growth rate method is defined by $M = (r - r^1)$.

Table 12-1 gives the estimated net migration by the growth rate method for the present Madras State during 1951-61.

TABLE 12-1

Estimated net migration by the growth rate method for Madras State

Decade		Decennial growth rate per 1,000 per annum		Net migration per 1,000 per annum
		Madras r	All India r^1	$(r-r^1)$
1901—11	...	8.3	5.6	2.7
1911—21	...	3.2	− 0.3	3.5
1921—31	...	8.5	10.5	—2.0
1931—41	...	11.3	13.4	—2.1
1941—51	...	13.8	12.6	1.2
1951—61	...	11.3	19.8	—8.5
1901—61	...	9.4	10.2	—0.8

TABLE 12–2

Persons born abroad and enumerated in Madras State, 1961

Country where born	Total			Rural			Urban		
	Persons	Males	Females	Persons	Males	Females	Persons	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Countries in Asia beyond India (including U.S.S.R.) ...	**75,645**	**38,916**	**36,729**	**40,356**	**20,475**	**19,881**	**35,289**	**18,441**	**16,848**
Afghanistan ...	32	25	7	2	1	1	30	24	6
Burma ...	18,115	8,685	9,430	7,582	3,640	3,942	10,533	5,045	5,488
Ceylon ...	23,428	11,520	11,908	15,553	7,605	7,948	7,875	3,915	3,960
China ...	153	62	91	8	...	8	145	62	83
Nepal ...	2,645	2,231	414	476	399	77	2,169	1,832	337
Pakistan ...	7,095	4,252	2,843	710	625	85	6,385	3,627	2,758
Singapore, Malaya and British Borneo ...	22,683	10,963	11,720	15,013	7,300	7,713	7,670	3,663	4,007
U. S. S. R. ...	55	21	34	...	...	...	55	21	34
Elsewhere ...	1,439	1,157	282	1,012	905	107	427	252	175
Countries in Europe (excluding U.S.S.R.) ...	**2,723**	**1,517**	**1,206**	**349**	**168**	**181**	**2,374**	**1,349**	**1,025**
U.K. (including N. Ireland) ...	1,359	646	713	146	61	85	1,213	585	628
Elsewhere ...	1,364	871	493	203	107	96	1,161	764	397
Countries in Africa ...	**1,035**	**615**	**420**	**347**	**217**	**130**	**688**	**398**	**290**
Kenya ...	3	1	2	3	1	2	...	...	...
Mauritius ...	2	2	...	...	...	...	2	2	...
Mozambique ...	5	2	3	5	2	3	...	...	...
South Africa ...	410	233	177	209	140	69	201	93	108
Elsewhere ...	615	377	238	130	74	56	485	303	182
Countries in America ...	**823**	**473**	**350**	**110**	**50**	**60**	**713**	**423**	**290**
Canada ...	70	32	38	12	6	6	58	26	32
U.S.A. ...	741	430	311	97	44	53	644	386	258
Elsewhere ...	12	11	1	1	...	1	11	11	...
Countries in Oceania ...	**283**	**134**	**149**	**37**	**19**	**18**	**246**	**115**	**131**
Australia ...	87	26	61	13	5	8	74	21	53
New Zealand ...	25	18	7	4	2	2	21	16	5
Elsewhere ...	171	90	81	20	12	8	151	78	73

We may infer from the Table 12-1 that Madras State has gained in population during all decades excepting 1921-31 and 1931-41. There has been an overall net out-migration of 0.8 per thousand persons during the period 1901-61. In the decade 1951-61, the net migration was —8.5 per 1,000 as against 1.2 per 1,000 in 1941-51. There appears to be a reversal in the migration trend during the last decade. If we examine still further, it appears that the 1941-51 decade and not 1951-61 was the exceptional decade in the sense that this was the only decade after 1921 to have experienced an in-migration. The net in-migration noticed for 1911-21 appears to be doubtful and this can be attributed to the limitation of the assumption involved in the above method, namely the assumption of constancy of the rate of natural increase between Madras and India. The period 1911-21 witnessed the great Influenza epidemic in both Madras as well as in the rest of India, but the force of the epidemic seems to be heavier in the other States. If we make allowance for this fact, the net migration is likely to be much less than the observed figure of 3.9 and the figure may even be negative. The above argument brings out the limitations of this method but it won't do any good to dismiss the method altogether.

Survival Ratio Method

In the Growth Rate Method, we have assumed the constancy of natural increase rate of Madras and India. The rate of natural increase is the difference between the birth rate and death rate. The assumption of constancy of rate of natural increase implies that either both these constituents remain the same from State to State or they vary in such a manner as to leave their difference unaltered. If we confine the study to migration among people who are 10 years and above in the second Census, we need not consider the birth rate at all. It is enough if the constancy of death rate is assumed. The Survival Ratio Method is intended to serve this object.

This method consists in estimating the survivors at the time of the second Census among persons enumerated in the first Census and deducting this from the number enumerated in the second Census. This can be done for males and females separately and for different age groups. The following assumptions are implied in this procedure: (*a*) International migration during the intercensal period is negligible, (*b*) Mortality rate of each State is the same as that of the country as a whole.

If P_x^1 denotes the number of persons in India aged x to x+4 in one Census and P_{x+10}^2 denotes the number of persons in India aged x+10 to x+14 in the next Census 10 years later, then the survival ratio for the age group (x, x+4) to (x+10, x+14) is given by

$$S_x = \frac{P_{x+10}^2}{P_x^1}$$

Now if the number of persons aged (x, x+4) in Madras State in the first Census is M_x^1 then the survivors among them to the age group (x+10, x+14) at the time of the next Census will be

$$M_x^1 S_x = M_x^1 \frac{P_{x+10}^2}{P_x^1}$$

Further, if the number actually enumerated in the age group (x+10, x+14) in Madras State in the latter Census is M_{x+10}^2, then the net migration is N_{x+10} in the age group (x+10, x+14)

$$N_{x+10} = M_{x+10}^2 - M_x^1 S_x = M_{x+10}^2 - M_x^1 \frac{P_{x+10}^2}{P_x^1}$$

If this is positive, it means that in-migration has exceeded out-migration and that the State has actually gained population through migration.

Two important studies on migration in India during the decades 1901 to 1931 and for 1941-51 has been made by Prof. K. C. Zachariah based on this method and the results of these studies for the composite Madras State are presented in Tables 12-3 and 12-4. It appears from these tables that in 1901-11 there has been a net out-migration of 224,152 or 5.80 per 1,000 of the 1901 population of the composite Madras State. In 1911-21, there was a net out-migration of 277,456 or 663 per 1,000 of the 1911 population. The net out-migration was much higher in 1921-31 being of the order of 310,560 or 7.25 per 1,000 of the 1921 population. Zachariah has not made any estimates for the 1931-41 decade; for the 1941-51 decade he has found that the trend of migration of the composite Madras State had reversed resulting in a net in-migration of 1,207,000 or 24.22 per 1,000 of the 1941 population.

Zachariah's estimates for 1901-11, 1911-21 and 1921-31 relate to migration from Madras State to the rest of India which included the areas which form the present Pakistan and Burma. For the 1941-51 decade, he has confined his study to India as at present excluding Jammu and Kashmir. This aspect has to be kept in mind while making comparison of the estimates obtained by him.

In the present study we have adopted the same procedure to compute the net migration for the present Madras State. This required the elaborate adjustment of the age-sex data for the present Madras State and also for India and the graduation of the age data

TABLE 12-3

Net Intercensal Migration for Composite Madras State by Age and Sex, 1901-31

Age Group		1901—11		1911—21		1921—31	
		Males	Females	Males	Females	Males	Females
0—14	...	−202,099	−114,410	−171,724	−19,667	−126,800	−1,236
15—29	...	−261,476	−134,176	−254,034	−98,827	−234,308	−26,916
30—44	...	93,437	−15,504	127,626	−439	47,201	−88,939
45—59	...	129,829	113,449	103,837	38,060	80,707	25,968
60+	...	94,476	72,322	18,999	−21,287	20,316	−6,553
Total	...	−145,833	−78,319	−175,296	−102,160	−212,884	−97,676
Rate per lakh of initial population	...	−765	−399	−851	−450	−1,009	−480

Source : K. C. Zachariah : Historical Study of Internal Migration in the Indian Sub-Continent, 1901-31. Demographic Training and Research Centre, Bombay (Mimeographed), pages 206 to 211 & 229, 230.

TABLE 12-4

Net Intercensal Migration during 1941-51

Age Group as on 1951 Census day		Net Migration (in 1,000)		Rate per 1,000 of average population	
		Males	Females	Males	Females
0—9	...	+87	+86	...	...
10—19	...	+43	+219	+7	+38
20—29	...	−233	−45	−53	−9
30—39	...	+179	+109	+50	+30
40—49	...	+341	+260	+122	+97
50—59	...	+150	+138	+81	+78
60+	...	−50	−77	−36	−54
Total 10+	...	+430	+604	+22	+30
Total	...	+517	+690	...	...

Source: K. C. Zachariah: Internal Migration in India, 1941-51. Demographic Training and Research Centre, Bombay, pp. 66-69.

for irregularities in the age distribution. The procedure adopted for the reconstruction of the age data for India and Madras State and their smoothing are presented in the Appendix.

The results obtained by us may be classified into two categories. (1) For India including Pakistan and Burma for 1901 to 1931. (2) For India as constituted now for 1921 to 1961. The advantage of these two sets of figures are that each series offers comparison among the period covered in that series. Secondly, the period 1921-31 is a watershed in the two series so as to enable a comparison between the net migration to India as existing at present and as it existed then. The first series is presented in Table 12-5 whereas the second series is shown in Table 12-6. The rate of net migration in respect of these two series in relation to the initial population of each decade has been presented in Tables 12-7 and 12-8.

The results are examined below. In 1901-11, Madras gained population through a net in-migration from other States of India including Burma and Pakistan of 709,390 or 36 per 1,000 of the 1901 population. In 1911-21 there was again a net in-migration of 741,597 or 35 per 1,000 of 1911 population. This is likely to be considerably less if we make allowance for the fact that Madras State had enjoyed a lower mortality than the rest of India during this decade.

TABLE 12–5

Migration Estimates for Madras State based on the Survival Ratio Method (including Pakistan & Burma) 1901-11, 1911-21 & 1921-31

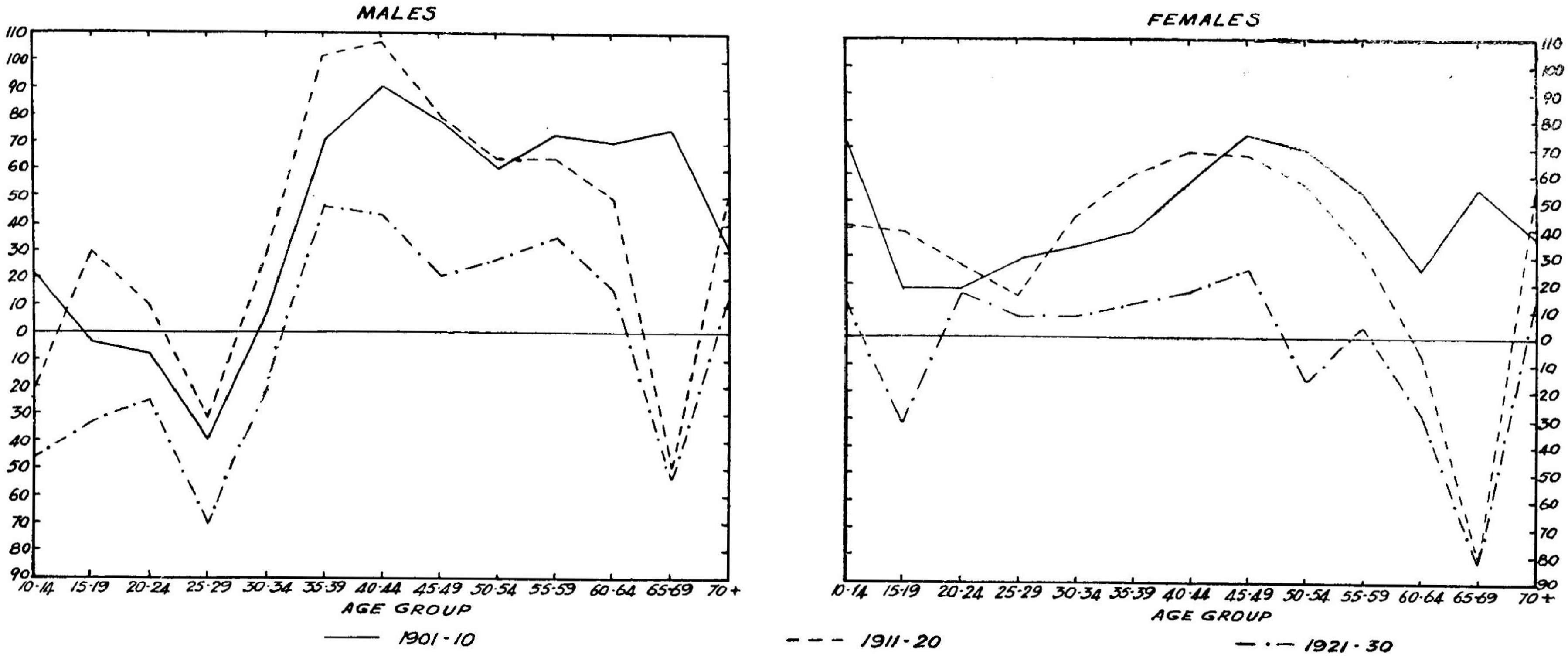
Age Group at the later Census		1901—11		1911—21		1921—31	
		Males	Females	Males	Females	Males	Females
10—14	...	+33,090	+105,398	−33,457	+66,826	−79,469	+19,962
15—19	...	−4,961	+24,024	+38,547	+52,112	−46,925	−46,614
20—24	...	−9,336	+18,674	+11,385	+29,163	−30,139	+19,232
25—29	...	−33,495	+24,250	−30,446	+14,331	−69,909	+7,422
30—34	...	+4,601	+27,352	+26,018	+41,567	−19,199	+7,735
35—39	...	+50,500	+32,147	+81,633	+54,784	+39,417	+11,903
40—44	...	+62,942	+44,590	+77,674	+55,106	+35,110	+15,069
45—49	...	+48,792	+47,917	+52,172	+46,372	+15,364	+17,897
50—54	...	+33,363	+38,390	+38,189	+33,982	+16,175	−9,802
55—59	...	+32,837	+24,760	+31,992	+16,353	+17,839	+2,021
60—64	...	+25,184	+9,044	19,773	−2,538	+6,920	−11,777
65—69	...	+19,984	+15,246	−14,803	−25,525	−18,012	−27,027
70+	...	+14,153	+19,944	28,037	+32,350	+7,309	+7,459
Total	...	+277,654	+431,736	+326,714	+414,883	−125,519	+13,480

TABLE 12–6

Migration Estimates for Madras State based on the Survival Ratio Method, 1921-31, 1931-41, 1941-51 & 1951-61 (India as constituted on 1st March, 1961).

Age Group at the later Census			1921—31		1931—41		1941—51		1951—61	
			Males	Females	Males	Females	Males	Females	Males	Females
10—14	...	...	−197,188	−83,024	−116,599	+26,984	−124,850	+8,933	−302,330	−136,614
15—19	...	...	−45,307	−30,824	+93,427	+123,076	+163,869	−6,224	+10,059	+31,090
20—24	...	...	−21,379	+31,106	+51,425	+57,367	+22,559	−17,045	−64,366	−49,587
25—29	...	...	−62,698	−3,421	−16,670	−6,475	−86,033	−77,376	−140,254	−66,466
30—34	...	...	−22,103	−8,456	−12,641	−40,861	−43,734	−32,137	−102,900	−37,001
35—39	...	...	+33,492	+5,266	+8,939	−42,639	+65,140	+41,373	−1,311	−10,515
40—44	...	...	+29,969	+15,945	−1,639	−39,375	+89,795	+72,925	+25,091	−10,126
45—49	...	...	+12,628	+22,977	−31,156	−42,497	+75,530	+85,351	+735	−14,940
50—54	...	...	+15,909	+19,118	−38,743	−47,086	+64,569	+80,011	−14,993	−18,725
55—59	...	...	+19,600	+5,054	−19,810	−37,967	+58,695	+59,360	−19,013	−40,038
60—64	...	...	+10,522	−9,397	−33,024	−55,012	+43,912	+36,174	−29,303	−59,686
65—69	...	...	−1,530	−9,416	−62,211	−74,490	+7,003	+3,476	−35,981	−50,702
70+	...	...	−1,129	−2,975	−65,278	−68,778	−18,783	−18,647	−33,937	−49,756
Total		...	−229,214	−48,047	−243,980	−247,753	+317,672	+236,174	−708,503	−513,066

NET INTERCENSAL MIGRATION RATE FOR MADRAS STATE PER 1000 OF INITIAL POPULATION 1901-10, 1911-20, 1921-30 (INDIA INCLUDING PAKISTAN AND BURMA)



NET INTERCENSAL MIGRATION RATE FOR MADRAS STATE PER 1000 OF INITIAL POPULATION
1921-30, 1931-40, 1941-50 AND 1951-60 (INDIA AS AT PRESENT)

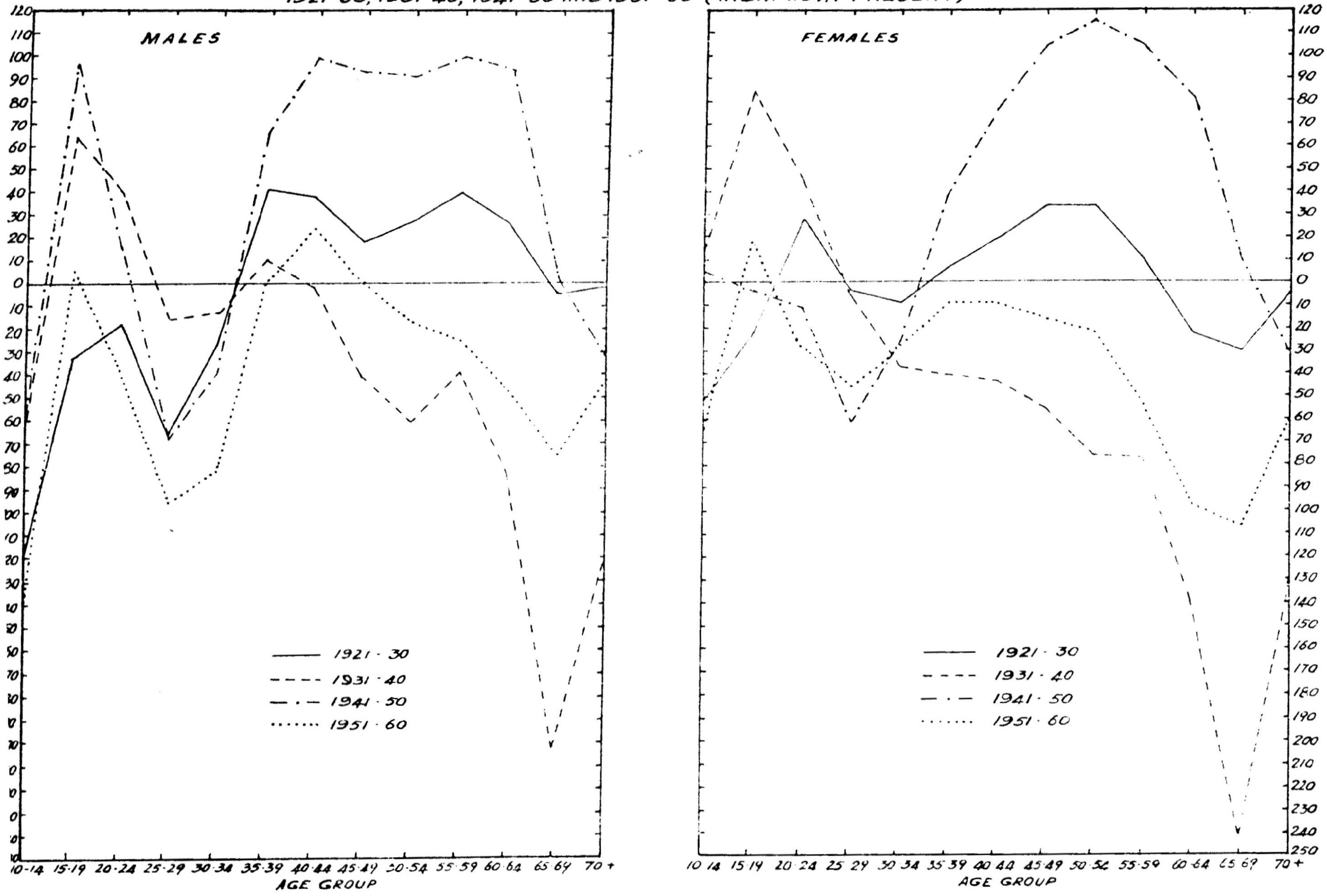


TABLE 12-7

Net Intercensal Migration rate for Madras State per 1,000 of Initial Population, 1901-11, 1911-21 & 1921-30. (India including Pakistan and Burma)

Age Group at the later Census	1901—10		1911—20		1921—30	
	Males	Females	Males	Females	Males	Females
10—14	+22	+72	+20	41	46	12
15—19	-4	+18	+29	39	-33	-32
20—24	-8	+18	+10	26	-25	-16
25—29	39	+29	-32	15	-71	+8
30—34	+7	+34	+31	44	-22	+8
35—39	+71	39	102	60	+46	+12
40—44	91	58	107	69	+43	+17
45—49	78	75	79	68	+21	+25
50—54	+61	70	64	57	+27	−16
55—59	+73	54	+64	32	+35	+4
60—64	+70	25	+49	−6	+16	−28
65—69	+75	+55	-48	−81	-54	−82
70+	-29	+37	49	+53	+12	+12
All Ages	29	+44	+31	+38	−11	+1

TABLE 12-8

Net Intercensal Migration rate for Madras State per 1,000 of Initial Population, 1921-30, 1931-40, 1941-50 & 1951-60 (India as at present)

Age Group at the later Census	1921—30		1931—40		1941—50		1951—60	
	Males	Females	Males	Females	Males	Females	Males	Females
10—14	−119	−51	−60	+14	−59	4	−138	−65
15—19	−33	−22	+64	+84	+96	−4	+6	+18
20—24	−18	+27	+40	+45	+15	−12	−38	−29
25—29	−66	−4	−16	−6	−69	−62	−96	−46
30—34	−27	−9	−13	−37	−40	−27	−82	−28
35—39	+41	+6	+10	−41	+66	+38	−1	−9
40—44	+38	+19	−2	−44	+99	+76	+24	−9
45—49	+18	+33	−41	−56	+93	+104	+0·8	−16
50—54	+27	+33	−61	−76	+91	+115	−17	−22
55—59	+40	+10	−39	−77	+99	+104	−25	−54
60—64	+26	−23	−84	−140	+94	+81	−47	−97
65—69	−5	−30	−203	−242	+2	+10	−75	−107
70+	−2	−5	−123	−130	−32	−31	42	−60
All Ages	−22	−4	−21	−21	+24	+18	−47	−34

In 1921-31, we find a net out-migration of 112,039 or 5 per 1,000 of population to India including Burma and Pakistan, whereas for the present areas of India, the net out-migration was higher *viz.*, 277,261 or 13 per 1,000 of population. This seems to indicate that Madras State had some in-migration or more probably a return migration from Burma and Pakistan.

From 1921-31 to 1951-61 we have a series of estimates which are comparable and which relate to the present set up of India as well as Madras State. It is interesting to find that the 1941-51 decade stands apart from the remaining decades, as a period of net in-migration. The reasons for this reversal in this decade are not difficult to understand if we realise the difficult conditions under which Tamilians had to live in other countries as a result of the Second World War. Added to this, the post-war spirit of nationalism in these countries made the local population to look at Indians as others and several economic disabilities have been placed on them. It is therefore not surprising that there was a net in-migration of 553,846 in the 1941-51 decade or 21 per 1,000 of the 1941 population. In 1951-61, the position seems to have changed again and the mobility of Madrasis seems to have asserted itself with greater vigour and over 12 lakhs of persons have migrated to other States in India. The net out-migration during this decade works out to 4.06% of the 1951 population.

It is interesting to compare this estimate with the one derived from the population projections for Madras State obtained by Vaidyanathan for 1961.

The comparison is attempted in the following table.

TABLE 12-9

Comparison of Net migration estimates by Census Survival Ratio Method and Vaidyanathan's Projections, 1951-61

(Figures in lakhs)

Age Group		Smoothed Population, 1961		Vaidyanathan's Projections		Net migration in (+) or out (−)		Net migration by Census Survival Ratio Method	
		Males	Females	Males	Females	Males	Females	Males	Females
0—4	...	26.7	24.5	25.8	24.5	+0.9	...	...	...
5—9	...	21.0	21.2	21.6	20.3	—0.6	+0.9	...	...
10—14	...	18.0	17.8	18.0	16.7	...	+1.1	—3.0	—1.4
15—19	...	15.0	15.3	16.4	16.9	—1.4	—1.6	+0.1	+0.3
20—24	...	13.8	14.9	16.1	16.3	—2.3	—1.4	—0.6	—0.5
25—29	...	13.1	14.3	13.8	14.0	—0.7	+0.3	—1.4	—0.7
30—34	...	11.9	12.4	11.7	12.2	+0.2	+0.2	—1.0	—0.4
35—39	...	10.8	10.5	10.7	11.3	+0.1	—0.8	...	—0.1
40—44	...	9.6	8.9	9.7	9.9	—0.1	—1.0	+0.2	—0.1
45—49	...	8.2	7.6	8.8	8.4	—0.6	—0.8	...	—0.1
50—54	...	6.7	6.3	7.5	7.2	—0.8	—0.9	—0.2	—0.2
55—59	...	5.2	4.9	6.1	6.1	—0.9	—1.2	—0.2	—0.4
60—64	...	3.8	3.7	4.6	4.7	—0.8	—1.0	—0.3	—0.6
65—69	...	2.5	2.5	3.1	3.2	—0.6	—0.7	—0.4	—0.5
70+	...	2.8	2.9	3.0	3.2	—0.2	—0.3	—0.3	—0.5
All Ages	...	169.1	167.7	176.9	174.9	—7.8	—7.2	—7.1	—5.2

It appears from Table 12-9 that the net migration for the decade obtained by these two methods are fairly close to each other, but there are large variations between the two estimates in individual age groups. Such variations may be due to derivation of the assumptions implied in the population projections regarding fertility and mortality from the actual situation and also due to the smoothing process itself which could have smoothed out some real irregularities in the age structure of the population. It is known that changes in fertility can cause differences in the size of the age groups 0-4 and 5-9 in two Censuses 10 years apart, but we do not have migration estimates for these two age groups by the Census Survival Ratio Method and so no comparison can be attempted with the migration estimates for these two age groups from the population projections. If the population projections are any guide, they only indicate that in the 0-4 and 5-9 age groups there was a net in-migration of 30,000 males and 90,000 females. This is somewhat surprising in the light of a net out-migration in the older age groups. Since we do not know which of these results is more accurate it is difficult to evaluate any one method in the light of the other. However, it is a matter of satisfaction that these two estimates differ only by a small margin for the total population and indicate a net out-migration of 12 to 14 lakhs of Madrasis to other States during the 1951-61 decade.

Before we come to any definite conclusions it is better to summarise the limitation of these methods. The chief assumptions involved in the Survival Ratio Method are:

(1) The national population is closed *i.e.*, entered only by birth and left only by death.

(2) The specific mortality rates are the same for each State as for the nation.

(3) The ratio of the degree of enumeration in the age-sex group in the State (*i.e.*, the proportion which the enumerated population bears to the true population) to that of the nation is the same for the same cohort in both Censuses.

Dr. Zachariah has shown that the influence of international migration is quite negligible. The specific mortality rates are not the same for Madras State as that of India. In the earlier decades, Madras has definitely enjoyed a lower mortality rate than the rest of India, but it is common experience in several countries that after a certain stage, further reduction in mortality is difficult to attain. Therefore, it appears likely that the level of mortality between India and Madras should have equalised in 1951-61 or Madras is only slightly better than the rest of India. At any rate the influence of this factor though significant may lead to an inflation of the net out-migration during the decade 1951-61 only to a small extent. Therefore, we may treat the net out-migration estimate as a possible upper limit of the true position.

Place of birth data in Indian Censuses

A major source of data on migration in India is the place of birth data. Every Census in India since 1881 has included a question on place of birth. The usual question on place of birth required each person to report the district in which he was born, and if he were born outside the Province or State of enumeration, to give also the Province or State of his birth, and if he were born outside India, to indicate his native country. The procedure for tabulation was more or less same in the Censuses of 1901, 1911 and 1921 and somewhat restricted in the 1931 Census.

In the first three Censuses, for each district in the State it is possible to get the number of people (1) enumerated and born in the district; (2) enumerated in the district and born in each of the other districts of the State; (3) enumerated in the district and born in each of the other States or Provinces in the country; (4) enumerated in the district and born in each of the countries outside India. In 1931, however, items (1), (3) and (4) were available in full, but item (2) was restricted to persons enumerated in the district and born in contiguous districts of the same State, and all other districts taken together. This has created difficulties in the study of district by district migration within the State. Further, the district of birth of persons born outside the State or Province of enumeration is not available in any of these and this has made it difficult to make adjustments for territorial changes. Another major drawback is the absence of age distribution of the migrants obtained from place of birth statistics.

Accuracy of place of birth data

Errors in place of birth data can arise from (1) under enumeration of migrants and/or (2) mis-statement of place of birth. The mis-statement of place of birth arises mainly from the procedure for enumeration followed in India. The particulars required in respect of each individual is gathered at the census from the head of each household, and it is likely that the head of the household is not aware of the place of birth of some of the members. This could lead to some unintentional mis-statement of place of birth. Secondly, there have been a large number of boundary changes which could contribute to inaccuracies in the place of birth data. The net effect of these errors on our data

will however be small and the data could be used with suitable refinement. According to Kingsley Davis, the data are reasonably accurate.

Next to the question of accuracy we will have to consider how far the data will be adequate. In India, there are some special customs that make the place of birth of a person a mere accident. A high percentage of Indian women return to the father's household to bear the first child and often the second and subsequent children. This custom, together with the practice of taking a wife from another village which may be in another district or State, can also lead to errors in the estimation of migration from place of birth data.

Yet another factor affecting the place of birth statistics is the mode of enumeration. Prior to 1941, the Census count is based on *de facto* method and each individual was enumerated wherever he is found, and not at his usual place of residence. This could lead to a neglect of some real migration whereas an appreciable number of casual movements are counted.

Method of estimation

The following table presents the place of birth statistics of the earlier Censuses together with net migrants and the intercensal variation in the net migrants.

TABLE 12-10

Place of birth statistics of Composite Madras State, 1901 to 1951

Census Date	Born elsewhere and enumerated in Madras	Born in Madras State & enumerated in other States	Difference (2)—(3)	Net intercensal migration
1	2	3	4	5
1901 ...	226,797	711,431	−484,634	...
1911 ...	225,437	823,073	−597,636	−113,002
1921 ...	191,925	646,481	−454,556	+143,080
1931 ...	243,711	914,544	−670,833	−216,277
1941 ...	473,387	1,285,480	−812,093	−141,260

The figures in Col. (5) seem to indicate a net out-migration during 1921-31 and 1931-41, preceded by a net in-migration in 1911-21. Since these figures relate to the composite Madras State, we cannot draw any conclusions regarding the migration trends of the present Madras State. From the methodological point of view also, the above computation suffers from a serious limitation. This is examined below.

If 'I' stands for the number of persons enumerated in a State and born elsewhere in the country, and 'O' the number of people born in the State and enumerated elsewhere in the country, we may define I as the life-time in-migrants to the State and O as the life-time out-migrants from the State. The difference between the two ($I - O = M$) will therefore be a measure of the number of life-time net migrants. Here, I, O and M do not relate to any defined period, but they could be utilised to obtain estimates of migration in any given period by a differencing process. Thus, if I_1, O_1 and M_1 are the in, out and net life-time migrants in 1951 of a given State and I_2, O_2 and M_2 the corresponding quantities in 1961, the difference $(I_2 - O_2) - (I_1 - O_1)$ may be taken as an estimate of net migrants to this State during the decade 1951-61. This can be expressed in a slightly different form as follows:

$I_2 - I_1 =$ Net migrants during the decade to the State among persons born outside the State.

$O_1 - O_2 =$ Net migrants during the decade to the State among persons born in the State.

and $(I_2 - I_1) + (O_1 - O_2) =$ total net migrants during the decade to the State.

Zachariah has examined the extent of inaccuracies in the estimates of migration obtained by this method and concluded that (1) if the death rates are high, migration estimates obtained without mortality correction may be in error by a significant extent; and (2) even if deaths among the migrants in the beginning of the decade are taken care of, migration estimates will still be in error by the difference between the deaths among the in-migrants and those among the out-migrants during the decade.[1] Zachariah has suggested the following formula for the estimation of intercensal migration from the birth place data.

$$M = (I_2 - O_2) - S\,(I_1 - O_1)$$

where S is the 10 year survival ratio applicable to the decade. In his opinion, the application of these ratios has yielded a set of migration estimates which are nearer

[1] K. C. Zachariah: A Historical Study of Internal Migration in the Indian Sub-continent, 1901-31, Demographic Training & Research Centre, Bombay, p. 70.

the true figures than those obtained without mortality correction and these corrected estimates describe the broad pattern of internal migration in the country. He has estimated the survival ratios for the three decades 1901--11, 1911--21 and 1921—31, and these are given below:

TABLE 12-11

Overall survival ratios of persons born outside the State of enumeration

Period		Survival Ratios	
		Males	Females
1901--11	...	0.79	0.78
1911—21	...	0.75	0.74
1921—31	...	0.81	0.79

Source: K. C. Zachariah: A Historical Study of Internal Migration in India, 1901-31, p. 88.

Results for Composite Madras State

Zachariah's study relates to the composite Madras State and will be of indirect interest to us. The figures are intercensal migrants for the composite Madras State for the decades 1901-11, 1911-21 and 1921-31 which are presented below:

TABLE 12-12

Net Migration of In-State and out of State born by sex for Composite Madras State (in thousands)

Period	Males			Females		
	Out of State Born	In-State Born	Total	Out of State Born	In-State Born	Total
1901-11 ...	20	−166	−146	19	− 98	− 79
1911-21 ...	14	−189	−175	7	−110	−103
1921-31 ...	41	−254	−213	43	−141	− 98

Source: K. C. Zachariah: A Historical Study of Internal Migration in India, 1901-31, p. 101.

The details of the balance of migration between composite Madras State and other States are given in Tables 12-13 to 12-15. The picture revealed by these tables is one of an excessive out-migration of both the sexes to other States. The net out-migration is of the order of 214,000 in 1901-11, 277,000 in 1911-21, and 310,000 in 1921-31. The major recipients of the net outflow of migrants in 1901-11 are Burma and Mysore and Travancore-Cochin is also likely to be a major recipient, but no separate figures are available. In 1921-31, the major recipients are Burma, Travancore-Cochin, Mysore and Hyderabad. In 1911-21, Burma, Mysore, and Hyderabad rank as the major receiving States of Madrasi migrants. For the 1941-51 decade, the place of birth data could not be used for working out the intercensal migration estimates from the place of birth data as the place of birth statistics are not available for 1941. It is probably due to this that Zachariah has confined his study of migration to the 'life-time migration,' a concept suggested by him to distinguish the persons who are born in one State and

TABLE 12-13

Balance of Migration between Composite Madras and Travancore-Cochin and other States in India, by Sex, 1901-11

(*from place-of-birth data*)

State of Origin		Males	Females	Total
India	...	−143,316	− 71,056	− 214,372
United Provinces	...	− 1,258	− 712	− 1,970
East Zone	...	− 22,997	− 22,699	− 45,696
Bihar-Orissa & Bengal	...	− 15,002	− 13,177	− 28,179
Assam	...	− 7,995	− 9,522	− 17,517
Burma	...	− 79,659	− 18,093	− 97,752
South Zone	...	− 25,755	− 20,041	− 45,796
Mysore	...	− 25,755	− 20,041	− 45,796
Bombay	...	− 8,120	− 5,446	− 13,566
Central Zone	...	− 5,463	− 3,829	− 9,292
Hyderabad	...	− 7,461	− 5,124	− 12,585
Central Provinces	...	2,302	1,207	3,509
Central India	...	− 304	88	− 216
North-West Zone	...	− 64	− 236	− 300
Rajputana	...	118	28	146
Punjab & N.W.F. Province	...	− 275	− 231	− 506
Baluchistan	...	99	− 23	76
Jammu and Kashmir	.	− 6	− 10	− 16

enumerated in another State. The limitation of this method is that no definite period of migration can be specified and persons born at different periods and moved to the place of enumeration at different periods cannot be distinguished. Such an estimate can at best be regarded as an average experience of a generation.

TABLE 12-14

Balance of Migration between Composite Madras and other States in India by Sex, 1911–1921

(from place-of-birth data)

State of Origin		Males	Females	Total
India	...	−175,297	−102,163	−277,460
United Provinces	...	119	41	160
East Zone	...	− 22,716	− 22,221	− 44,937
Bihar-Orissa	...	1,941	4,394	6,335
Bengal	...	− 10,323	− 12,025	− 22,348
Assam	...	− 14,334	− 14,590	− 28,924
Burma	...	− 70,903	− 15,624	− 86,527
South Zone	...	− 48,168	− 47,934	− 96,102
Travancore-Cochin	...	− 8,738	− 12,879	− 21,617
Mysore	...	− 39,430	− 35,055	− 74,485
Bombay	...	− 11,279	− 4,282	− 15,561
Central Zone	...	− 19,624	− 12,153	− 31,777
Hyderabad	...	− 24,255	− 15,650	− 39,905
Central Provinces	...	4,722	3,545	8,267
Central India	...	− 91	− 48	− 139
North-West Zone	...	− 2,726	10	− 2,716
Rajputana	...	240	191	431
Punjab	...	− 1,109	− 28	− 1,137
Baluchistan	...	− 167	− 20	− 187
N.W. Frontier Province	...	− 1,690	− 131	− 1,821
Jammu and Kashmir.		0	− 2	− 2

TABLE 12-15

Balance of Migration between Composite Madras and other States in India, by Sex, 1921-31

(from place-of-birth data)

State of Origin		Males	Females	Total
India	...	− 212,882	− 97,677	−310,559
United Provinces	...	754	16	738
East Zone	...	− 20,776	− 17,199	− 37,975
Bihar-Orissa	...	− 3,840	− 5,898	− 9,738
Bengal	...	− 7,820	− 6,612	− 14,432
Assam	...	− 9,116	− 4,689	− 13,805
Burma	...	− 57,599	− 18,258	− 75,857
South Zone	...	− 68,551	− 60,656	−129,207
Travancore-Cochin	...	− 34,681	− 39,760	− 74,441
Mysore	...	− 33,870	− 20,896	− 54,766
Bombay	...	− 12,846	− 10,753	− 23,599
Central Zone	...	− 56,332	9,442	− 46,890
Hyderabad	...	− 52,203	14,023	− 38,180
Central Provinces	...	− 3,977	− 4,385	− 8,362
Central India	...	− 152	− 196	− 348
North-West Zone	...	2,468	− 237	2,231
Rajputana	...	1,345	284	1,629
Punjab	...	− 144	− 490	− 634
Baluchistan	...	253	− 7	246
N.W. Frontier Province	...	996	− 30	966
Jammu and Kashmir .		18	6	24

TABLE 12-16

Life-time migrants, Composite Madras State, 1951

		Number	Ratio per 1,000 of 1951 Population
Males	...	−486,719	−20
Females	...	−340,052	−12
Persons	...	−826,771	−16

These figures indicate that the resultant life-time migration prior to 1951 was outward whatever be the trend of migratory movements during particular decades.

Estimates of migration between present Madras State and the rest of India in 1951-61 based on the place of birth data

The "place of birth" data available for the 1951 Census relate to the pre-reorganised Madras State and therefore need adjustment for purposes of comparison with the 1961 Census data on place of birth. This has involved elaborate computations and several assumptions and a reference to the details is available in the Appendix. The figures are presented below:

TABLE 12-17

Data on place of birth, Madras State, 1951 and 1961 Census

Year		Born elsewhere and enumerated in the State	Born in the State and enumerated elsewhere in India
1951	...	456,147	519,039
1961	...	587,745	1,095,393

The 10 year survival ratio for 1951-61 obtained as a ratio of population 10 years and over in 1961 to the total population in 1951 is found to be 0.8519. Using this survival ratio and substituting the figures of in and out-migrants in the equation

$$M = (I_2 - O_2) - S(I_1 - O_1)$$

we get a net out-migration of 454,070 in the decade 1951-61. This constitutes 1.5% of the population of 1951.

Place of birth data classified by duration in 1961 Census

In the 1961 Census, the migrants are classified by duration of residence at the place of enumeration and these could be used for studying intercensal migration.

TABLE 12-18

In and out-migrants during the last 10 years

		Males	Females
In-migrants	...	198,589	171,756
Out-migrants	...	380,188	316,858
Net	...	−181,599	−145,102

The total migration is outward of the order of 326,701 in the decade 1951-61. This is low when compared to the estimate obtained earlier. Migration data obtained from the place of birth record like every other information obtained in a Census are subject to recall lapse and even deliberate misreporting arising from the difficulty of the respondents to report the correct place of birth. The data are also subject to the operation of mortality and the migrants enumerated at the Census are the survivors of the actual migrants and since this factor operates both on in-migrants as well as out-migrants, it is difficult to estimate the effect of this factor on net migration. However, it is likely that the effect of this factor is likely to be negligible and could be ignored. On the other hand, recall lapse or deliberate misreporting is bound to operate seriously and the following figures seem to reflect thus:

TABLE 12-19

Number of in and out-migrants per annum*

Duration of residence (Years)		In-migrants		Out-migrants	
		Males	Females	Males	Females
Less than 1	...	44,965	30,129	97,115	63,123
1— 5	...	24,914	21,589	45,914	38,857
6—10	...	10,793	11,055	19,883	19,662

* For periods 1-5 and 6-10 years the number of migrants have been divided by 4 and 5 to obtain annual figures.

It appears these figures reflect the operation of recall lapse or misreporting rather than a decline in the extent of annual migration. If the figures for less than 5 year duration is examined, we get a net out-migration of 238,216 during the last 5 years. In a decade, net out-migration will be of the order of 476,430. If instead we accept the annual rate revealed by those of less than one year's duration as applicable to the whole decade, we have a net out-migration of 851,440 during the decade. If we compare the figures obtained by the place of birth data with those obtained by the Census Survival Ratio Method and also the Projection Method, the place of birth data appear to be an under-estimate.

It is interesting to compare the place of birth statistics with those of the language returns. This is attempted in Table 12-20. It appears from this table that the number of persons born in Madras State and enumerated in other States is far less than the number returned as per the language tables.

TABLE 12-20

Comparison of Language and Migration Returns

States where Enumerated	Migrants from Madras			Tamil-Speaking Persons		
	Persons	Males	Females	Persons	Males	Females
Andhra ...	171,908	79,388	92,520	434,713	224,750	209,963
Assam ...	7,626	4,942	2,684	4,501	3,222	1,279
Gujarat ...	11,766	7,398	4,368	13,264	7,894	5,370
Jammu & Kashmir ...	542	316	226	349	268	81
Kerala ...	192,287	101,031	91,256	527,613	268,655	258,958
Madhya Pradesh ...	19,665	12,251	7,414	26,173	16,722	9,451
Maharashtra ...	121,192	74,109	47,083	159,396	95,158	64,238
Mysore ...	396,720	210,377	186,343	854,227	447,832	406,395
Orissa ...	8,565	5,390	3,175	6,918	4,126	2,792
Punjab ...	7,395	5,318	2,077	6,789	5,109	1,680
Rajasthan ...	3,869	2,439	1,430	3,443	2,046	1,397
Uttar Pradesh ...	10,699	6,548	4,151	12,399	9,163	3,236
Delhi ...	19,135	10,711	8,424	22,962	12,606	10,356
Tripura ...	65	42	23	49	34	15
Pondicherry ...	68,506	21,909	46,597	325,840	162,403	163,437
West Bengal ...	39,005	23,630	15,375	32,663	20,762	11,901
Andaman and Nicobar Islands ...	4,453	3,623	830	5,765	4,345	1,420
Manipur ...	21	12	9	17	14	3
N.E.F.A. ...	528	515	13	...	...	...
Nagaland ...	120	104	16	86	75	11
Bihar ...	11,185	6,689	4,496	16,177	8,414	7,763
Goa, Diu & Daman ...	192	140	52	286	216	70
Himachal Pradesh ...	68	44	24	48	31	17
Laccadive, Minicoy and Amindivi Islands ...	47	27	20	43	25	18
Total ...	1,095,559	576,953	518,606	2,453,721	1,293,870	1,159,851

This is understandable to a certain extent as the latter will include children born to the migrants of even earlier periods. But what is surprising is that in some States like Andhra Pradesh and Mysore the number of Tamils far exceeds the number of migrants and this is perhaps due to an anxiety on the part of the Tamil migrants to report themselves as natives of these States. This possibility cannot be ruled out since in recent times there is a tendency in several States to make nativity a criterion in the matter of appointments and the Madrasi migrants are probably obliged to report themselves as natives of the States to which they have migrated.

The inevitable conclusion that emerges from the foregoing discussion is that migration estimates from place of birth data are likely to be under-estimated as far as Madras State is concerned, but the extent of under-estimation is difficult to gauge from the above figures. The Census Survival Ratio Method and the Projection Method also indicate that the number of persons born in Madras and enumerated in other States, but who have migrated during the last 10 years is somewhat undercounted. The analysis of the data for shorter duration indicates that the extent of undercount seems to increase with duration of migration, *i.e.*, the shorter the duration the less the extent of undercount.

The Residual Method

The residual method of estimating migration for a State may be symbolically expressed as follows. The Migration Rate (MR) is given by

M.R. = Growth Rate − Natural Increase Rate.

This method implies the correct estimation of the growth rate as well as the birth and death rates. From the reasoning presented in the earlier Chapters we have concluded that the birth rate of Madras State for the decade 1951-60 should be about 35 per 1,000 of population and the death rate may be about 20 per 1,000 of population. The growth rate of population of Madras State for 1951-60 has been 12 per 1,000 per annum. The net out-migration rate by the residual method is therefore 3 per 1,000 per annum or 3% in a decade. This may be compared with the estimated 3.7% net out-migration derived on the basis of an empirical analysis of the factors contributing to a lower growth rate of Madras State.

Summary and conclusions

We may now summarise the results obtained from different procedures, and attempt an evaluation of their suitability in measuring migration trends of Madras State. The following table presents the several estimates of migration obtained in the present study.

TABLE 12-21

Migration estimates of Madras State based on different methods

Methods	Net out-migration in 1951–61	Rate per lakh of 1951 Population
1. Comparison of Place of Birth Data of 1951 & 1961 ...	454,070	151
2. Based on Place of birth data for 1961 only:		
(*a*) Migrants of less than 10 years duration ...	326,701	108
(*b*) Projected from migrants of less than five years duration ...	476,430	158
(*c*) Projected from migrants of less than one year's duration ...	851,440	283
3. Census Survival Ratio Method ...	1,221,569	406
4. Projection Method ...	1,400,000	465
5. The Residual Method ...	...	300

The object of presenting all these figures in one table is to place before the reader the difficulties confronting a demographer in coming to any conclusion regarding the extent of migration. Acceptance of any one result implies the rejection of the rest and this will *ipso facto* involve the rejection of the principles underlying these methods. Certain refined procedures applicable in more statistically developed countries are not applicable in India, due to the limitations of data and further migration research itself is in its infancy in India with the result that we are no better than the lay reader in formulating our judgements regarding migration. The readers of this report are therefore at liberty to formulate their own judgements on the basis of the facts presented here.

However, for purposes of discussion in later Chapters and for explaining the trends of population growth, we are obliged to formulate our own views in the matter. Of the estimates presented here, from a methodological point of view, the Census Survival Ratio Method is the best. This is the well considered view of Prof. K. C. Zachariah, the well-known Indian authority on migration. Secondly, the projection approach based on the Projections of Population for 1961 by Vaidyanathan gives results very close to the estimates obtained by the Census Survival Ratio Method. If we

evaluate the assumptions involved in the projections, we find that the assumption regarding fertility (corresponding to a constant birth rate of 35 per thousand) is acceptable. While we feel that the mortality assumption involved in the projections needs a slight upward revision, such a change will not considerably affect the age structure and therefore the estimate based on this method will require a slight downward revision. The other methods presented here have not reached the status of methodology yet and are presented as mere alternative approaches to the problem of migration analysis and will require considerable scholarly effort before they can be refined, modified and improved upon to serve as tools of migration analysis. An independent approach to this problem based on the estimation of birth and death rates for the State and India has shown that the net out-migration can be of the order of 3.7% during the 1951-61 decade and our computations based on the Residual Method has shown a net migration of 3% in 1951-60. It is therefore our well considered opinion that the results obtained from the Census Survival Ratio Method can be accepted.

CHAPTER XIII

INTER-DISTRICT AND RURAL-URBAN MIGRATION

Next to international and inter-State migration, the migration between rural and urban areas and between one district and another is a subject of greatest importance in regional demography. This is yet another field where the techniques of analysis have not reached the highest point of perfection especially in situations such as ours, where the data are themselves subject to several limitations. Many of these defects have already been discussed in the earlier chapter. The object of this chapter is to analyse the inter-district and rural-urban migrations from the place of birth statistics and by alternative procedures.

Place of birth statistics, 1921 and 1931

Particulars of persons born in each district of the composite Madras State and enumerated in each of the other districts in 1921 is available in Part I of Table XI of 1921 Census Imperial Tables. From this table, the number of in and out-migrants to the districts of the present Madras State have been worked out and presented in Table 13-1. This type of cross-tabulation of the district of birth and the district of enumeration was not attempted in 1931. The estimated inter-district life-time migration as per the 1921 Census is presented in Table 13-2. It appears that the net migration has been outward in respect of Chingleput, North Arcot, South Arcot, Salem, Coimbatore, Thanjavur, Ramanathapuram and Tirunelveli districts. Chingleput stands as the district which had the maximum out-migration, followed by Salem and Tirunelveli districts. Madras, Nilgiris, Madurai and Tiruchirapalli are the districts which have received migrants from other districts. Of these Madras stood first with nearly a lakh of life-time migrants in 1921.

TABLE 13-1

Inter-District Migration in Madras State, Birth-Place Data, 1921

District where born			District where enumerated						
			Madras	Chingleput	North Arcot	South Arcot	Salem	Coimbatore	Nilgiris
(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)
				MALES					
Madras	...	...	...	7,876	2,085	1,269	295	774	1,006
Chingleput	...	...	35,991	...	6,067	2,560	123	168	130
North Arcot	...	...	10,379	7,605	...	5,986	1,358	502	647
South Arcot	...	...	6,672	3,797	8,003	...	1,103	240	71
Salem	...	...	1,392	720	4,149	1,946	...	5,628	647
Coimbatore	...	...	1,421	342	1,742	417	3,851	...	7,015
Nilgiris	...	...	336	61	29	16	21	530	...
Madurai	...	...	1,926	436	278	595	407	2,700	359
Tiruchirapalli	...	...	2,830	734	630	4,820	3,255	2,850	797
Thanjavur	...	...	6,604	1,869	1,285	5,926	346	909	238
Ramanathapuram	...	...	626	110	66	137	49	100	4
Tirunelveli	...	...	2,261	593	237	495	179	421	112
Kanyakumari	...	...	...	...	...	...	...	...	...
State	...	...	70,438	24,143	24,571	24,167	10,987	14,822	11,026

TABLE 13-1—(*Contd.*)

Inter-District Migration in Madras State, Birth-Place Data, 1921—(*Contd.*)

District where born			District where enumerated—(*Contd.*)						
			Madurai	Tiruchirapalli	Thanjavur	Ramanathapuram	Tirunelveli	Kanyakumari	State
			(9)	(10)	(11)	(12)	(13)	(14)	(15)
			MALES—(*Contd.*)						
Madras	...	...	577	813	1,166	199	127	...	16,187
Chingleput	...	...	189	299	655	266	72	...	46,520
North Arcot	...	...	126	275	463	93	64	...	27,498
South Arcot	...	...	392	5,731	5,243	187	110	...	31,549
Salem	...	...	688	8,876	1,960	268	519	...	26,793
Coimbatore	...	...	3,673	5,570	833	312	413	...	25,589
Nilgiris	...	...	56	126	46	5	21	...	1,247
Madurai	...	...	...	6,903	3,000	5,589	2,094	...	24,287
Tiruchirapalli	...	...	4,743	...	10,625	3,023	464	...	34,771
Thanjavur	...	...	1,655	14,158	...	2,435	800	...	36,225
Ramanathapuram	...	...	9,850	3,301	2,841	...	3,072	...	20,156
Tirunelveli	...	...	6,067	1,658	1,460	7,443	...	...	20,926
Kanyakumari	...	...	...	...	...	...	...	...	...
State	...	...	28,016	47,710	28,292	19,820	7,756	...	311,748

TABLE 13-1—(*Contd.*)

Inter-District Migration in Madras State, Birth-Place Data, 1921—(*Contd.*)

District where born			District where enumerated—(*Contd.*)						
			Madras	Chingleput	North Arcot	South Arcot	Salem	Coimbatore	Nilgiris
(1)			(2)	(3)	(4)	(5)	(6)	(7)	(8)
			FEMALES						
Madras	...	...	...	9 746	2,661	1,513	214	629	1,049
Chingleput	...	...	29,248	...	10,086	3,535	94	63	117
North Arcot	...	...	8,296	9,682	...	8,671	1,853	218	559
South Arcot	...	...	4,667	5,195	10,014	...	1,866	101	45
Salem	...	...	1,193	648	4,268	2,729	...	5,959	523
Coimbatore	...	...	1,099	286	583	338	4,290	...	5,592
Nilgiris	...	...	348	70	45	16	12	351	...
Madurai	...	...	2,138	311	200	421	332	2,557	215
Tiruchirapalli	...	...	2,104	567	487	8,525	3,748	2,999	908
Thanjavur	...	...	5,553	1,856	921	8,475	400	620	347
Ramanathapuram	...	...	418	55	50	58	26	36	...
Tirunelveli	...	...	1,612	367	160	330	116	254	100
Kanyakumari	...	...	...	...	...	...	...	...	...
State	...	...	56,676	28,783	29,475	34,611	12,951	13,787	9,455

TABLE 13-1—(*Contd.*)

Inter-District Migration in Madras State, Birth-Place Data, 1921—(*Contd.*)

District where born	District where enumerated—(*Contd.*) Madurai	Tiruchira-palli	Thanjavur	Ramanatha-puram	Tirunelveli	Kanya-kumari	State
	(9)	(10)	(11)	(12)	(13)	(14)	(15)
	FEMALES—(*Contd.*)						
Madras	671	1,148	1,191	235	93	...	19,150
Chingleput	118	239	593	128	39	...	44,260
North Arcot	74	380	426	55	103	...	30,317
South Arcot	341	11,940	6,384	102	93	...	40,748
Salem	486	10,728	1,832	168	449	...	28,983
Coimbatore	4,797	5,600	768	264	410	...	24,027
Nilgiris	63	181	59	1	5	...	1,151
Madurai	...	10,150	3,173	6,760	1,282	...	27,539
Tiruchirapalli	6,592	...	16,202	3,844	331	...	46,307
Thanjavur	1,815	22,667	...	2,251	487	...	45,392
Ramanathapuram	10,618	4,430	2,917	...	3,423	...	22,031
Tirunelveli	4,469	2,000	1,081	7,151	...	...	17,640
Kanyakumari	...	...	...	...	...	...	...
State	30,044	69,463	34,626	20,959	6,715	...	347,545

TABLE 13-2

Inter-District Migration, 1921

District	In-migrants Males	Females	Persons	Out-migrants Males	Females	Persons	Net migrants Males	Females	Persons
Madras ...	70,438	56,676	127,114	16,187	19,150	35,337	54,251	37,526	91,777
Chingleput ...	24,143	28,783	52,926	46,520	44,260	90,780	—22,377	—15,477	—37,854
North Arcot ...	24,571	29,475	54,046	27,498	30,317	57,815	—2,927	—842	—3,769
South Arcot ...	24,167	34,611	58,778	31,549	40,748	72,297	—7,382	—6,137	—13,519
Salem ...	10,987	12,951	23,938	26,793	28,983	55,776	—15,806	—16,032	—31,838
Coimbatore ...	14,822	13,787	28,609	25,589	24,027	49,616	—10,767	—10,240	—21,007
Nilgiris ...	11,026	9,455	20,481	1,247	1,151	2,398	9,779	8,304	18,083
Madurai ...	28,016	30,044	58,060	24,287	27,539	51,826	3,729	2,505	6,234
Tiruchirapalli ...	47,710	69,463	117,173	34,771	46,307	81,078	12,939	23,156	36,095
Thanjavur ...	28,292	34,626	62,918	36,225	45,392	81,617	—7,933	—10,766	—18,699
Ramanathapuram ...	19,820	20,959	40,779	20,156	22,031	42,187	—336	—1,072	—1,408
Tirunelveli ...	7,756	6,715	14,471	20,926	17,640	38,566	—13,170	—10,925	—24,095
Kanyakumari ...	...	...	...	...	...	...	...	...	...
State ...	311,748	347,545	659,293	311,748	347,545	659,293	...	...	...

Inter-district migration in 1951

In columns (5), (6) and (7) of Subsidiary Table 1.4 of Part 1-A of Madras Census Report for 1951, the figures of the persons born in other districts of the same natural division (South Madras Division) are taken as the migrants from other districts, since the area of South Madras Division roughly corresponds to the present Madras State. The figure for Nilgiris is taken from columns (8), (9) and (10) (other parts of the State) since most of the migrants are likely to be from Tamil districts only. The figure for present Chingleput district is obtained by totalling those for Chingleput and Chittoor districts and pro-rating on a population basis. The figures for males and females for Kanyakumari district are estimated from the number of migrants in respect of the remaining districts and again pro-rating on the basis of population (Vide Table 13-3).

This method enables only the estimation of in-migrants to each district from other districts of the State. It is however not possible to estimate the out-migrants from each district to the other districts of the State. Table 13-3 gives the number of in-migrants to each district from the other districts of the State. It is seen that over 1.5 million persons have moved from one district to another consisting of 7 lakh males and 8 lakh females. Females outnumber males in all districts except Madras and Nilgiris districts. In 1951, Madras had over 4 lakh persons born in other districts.

Inter-district migration in 1961

In the 1961 Census, in addition to collecting information on 'birth place' as in the earlier Indian Censuses, two new questions were introduced to elicit information (1) on the rural or urban character of the place of birth and (2) on the duration of residence of the person in the place of enumeration, if born elsewhere. The questions and the instructions which are of relevance to the estimation of inter-district migration are reproduced below:

Q. 4 (*a*) *Birth Place*

(1) If born in a village or town in which enumerated. ... Write PL

(2) If born in another village or town of district in which enumerated. ... Write D

(3) If born in another district in the State of enumeration. ... Write name of district

The data have been cross-tabulated between the district of birth and the district of enumeration and presented in D-II Appendix of Migration Tables, a synopsis of which is presented in Table 13-4. Over 9.2 lakh males and 11.4 lakh females have moved from their districts of birth to other districts and once again Madras stands as the district which has the maximum number of life-time migrants in 1961. The number of in, out and net migrants to each district is presented in Table 13-5 and the rates per thousand persons for each district are shown in Table 13-6.

TABLE 13-3

District-war Inter-District Migration, 1951

District		Born in other District			Estimated for present Madras		
		Persons	Males	Females	Persons	Males	Females
Madras	...	423,361	228,691	194,670	423,361	228,691	194,670
Chingleput	...	79,843	35,026	44,817	65,003	29,915	35,088
Chittoor	...	41,747	21,174	20,573			
North Arcot	...	83,398	31,297	52,101	84,577	31,741	52,836
South Arcot	...	85,291	33,286	52,005	85,291	33,286	52,005
Salem	...	69,518	29,705	39,813	69,329	29,524	39,805
Coimbatore	...	87,762	43,581	44,181	84,063	41,724	42,339
Nilgiris	...	84,167	44,145	40,022	84,167	44,145	40,022
Madurai	...	154,257	74,885	79,372	154,257	74,885	79,372
Tiruchirapalli	...	192,088	83,692	108,396	192,088	83,692	108,396
Thanjavur	...	163,309	78,470	84,839	163,309	78,470	84,839
Ramanathapuram	...	67,685	30,256	37,429	67,725	30,274	37,451
Tirunelveli	...	24,681	11,565	13,116	25,276	11,852	13,424
Kanyakumari	...	...	...	...	42,250	20,550	21,700
State	...	...	...	...	1,540,696	738,749	801,947

TABLE 13-4

Inter-District Migration in Madras State, Birth Place Data, 1961

District where born	Madras	Chingleput	North Arcot	South Arcot	Salem	Coimbatore	Nilgiris	Madurai	Tiruchirapalli	Thanjavur	Ramanathapuram	Tirunelveli	Kanyakumari	State
	District where enumerated													
							MALES							
Madras ...	...	24,779	6,885	4,664	1,702	2,748	1,022	1,751	2,751	2,923	712	885	120	50,942
Chingleput ...	74,285	...	10,565	3,368	530	568	352	389	675	1,163	188	167	19	92,269
North Arcot ...	39,585	19,676	...	8,668	7,543	1,647	1,572	588	1,322	2,354	207	215	55	83,432
South Arcot ...	25,529	8,268	11,213	...	2,530	1,675	557	909	6,813	12,324	376	377	41	70,612
Salem ...	7,264	2,141	5,836	5,441	...	21,754	4,607	1,578	17,900	2,836	484	351	82	70,274
Coimbatore ...	7,000	1,385	1,349	1,440	11,877	...	30,356	7,512	11,438	2,231	1,059	868	94	76,609
Nilgiris ...	1,347	279	230	119	345	3,061	...	238	636	177	66	145	16	6,659
Madurai ...	10,420	2,239	968	2,389	1,987	14,988	2,738	...	16,677	7,293	14,616	4,298	411	79,024
Tiruchirapalli ...	13,649	2,788	1,374	9,319	7,382	12,743	6,281	8,543	...	26,447	3,831	958	110	93,425
Thanjavur ...	25,671	5,497	1,828	12,129	1,967	3,843	875	4,344	23,206	...	3,155	1,250	148	83,913
Ramanathapuram ...	12,410	2,261	542	1,861	1,006	4,891	467	39,567	11,209	20,334	...	10,055	354	104,957
Tirunelveli ...	18,167	4,571	903	2,336	1,179	9,783	3,760	21,803	5,257	4,969	18,413	...	5,723	96,864
Kanyakumari ...	1,934	392	162	300	153	820	466	1,308	795	407	1,006	5,214	...	12,957
State ...	237,261	74,276	41,855	52,034	38,201	78,521	53,053	88,530	98,679	83,458	44,113	24,783	7,173	921,937

TABLE 13-4—(*Contd.*)

Inter-District Migration in Madras State, Birth Place Data, 1961—(*Contd.*)

District where born	Madras	Chin-gleput	North Arcot	South Arcot	Salem	Coim-batore	Nilgiris	Madurai	Tiruchi-rapalli	Thanjavur	Rama-natha-puram	Tiru-nelveli	Kanya-kumari	State
	District where enumerated													
						FEMALES								
Madras ...	...	36,359	10,680	6,940	1,753	2,768	1,048	2,081	3,646	3,696	867	1,043	33	70,914
Chingleput ...	75,391	...	26,692	7,086	565	521	297	394	778	1,354	145	144	18	113,385
North Arcot ...	35,676	37,091	...	23,770	11,752	1,327	1,291	497	1,423	2,193	173	145	19	115,357
South Arcot ...	22,956	11,640	24,638	...	4,398	1,297	450	665	20,473	19,043	290	223	27	106,100
Salem ...	6,008	1,879	8,743	7,787	...	23,556	4,221	1,630	26,403	2,960	421	344	50	84,002
Coimbatore ...	6,211	1,528	1,282	1,271	17,215	...	26,310	12,252	17,184	2,130	928	861	60	87,232
Nilgiris ...	1,383	454	298	123	406	3,107	...	326	926	213	74	140	20	7,470
Madurai ...	8,968	1,779	747	1,856	1,860	16,937	1,944	...	24,612	7,464	28,470	5,802	266	100,705
Tiruchirapalli ...	10,755	2,399	1,146	19,481	14,787	14,645	5,386	14,164	...	42,028	7,789	1,106	76	133,762
Thanjavur ...	21,527	4,536	1,706	19,354	2,028	3,450	730	4,536	42,714	...	3,964	1,196	72	105,813
Ramanathapuram ...	8,389	1,477	367	1,195	689	3,298	402	49,164	15,979	19,003	...	16,860	224	117,047
Tirunelveli ...	11,409	2,854	693	1,519	844	7,092	2,849	19,425	4,644	3,642	25,083	...	6,438	86,492
Kanyakumari ...	1,239	500	105	145	88	419	292	876	614	311	515	7,226	...	12,330
State ...	209,912	102,496	77,097	90,527	56,385	78,417	45,220	106,010	159,396	104,037	68,719	35,090	7,303	1,140,609

TABLE 13–5

Inter-District Life-time Migration in Madras State, 1961

District		In-migrants			Out-migrants			Net migrants		
		Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
Madras	...	237,261	209,912	447,173	50,942	70,914	121,856	186,319	138,998	325,317
Chingleput	...	74,276	102,496	176,772	92,269	113,385	205,654	—17,993	—10,889	—28,882
North Arcot	...	41,855	77,097	118,952	83,432	115,357	198,789	—41,577	—38,260	—79,837
South Arcot	...	52,034	90,527	142,561	70,612	106,100	176,712	—18,578	—15,573	—34,151
Salem	...	38,201	56,385	94,586	70,274	84,002	154,276	—32,073	—27,617	—59,690
Coimbatore	...	78,521	78,417	156,938	76,609	87,232	163,841	1,912	—8,815	—6,903
Nilgiris	...	53,053	45,220	98,273	6,659	7,470	14,129	46,394	37,750	84,144
Madurai	...	88,530	106,010	194,540	79,024	100,705	179,729	9,506	5,305	14,811
Tiruchirapalli	...	98,679	159,396	258,075	93,425	133,762	227,187	5,254	25,634	30,888
Thanjavur	...	83,458	104,037	187,495	83,913	105,813	189,726	—455	—1,776	—2,231
Ramanathapuram	...	44,113	68,719	112,832	104,957	117,047	222,004	—60,844	—48,328	—109,172
Tirunelveli	...	24,783	35,090	59,873	96,864	86,492	183,356	—72,081	—51,402	—123,483
Kanyakumari	...	7,173	7,303	14,476	12,957	12,330	25,287	—5,784	—5,027	—10,811
State	...	921,937	1,140,609	2,062,546	921,937	1,140,609	2,062,546	...	...	...

TABLE 13–6

Inter-District Life-time Migration Rate per 1,000 of 1961 Population

District		In-migrants			Out-migrants			Net migrants		
		Males	Females	Persons	Males	Females	Persons	Males	Females	Persons
Madras ...	...	267	256	259	56	87	70	211	169	189
Chingleput ...	...	66	95	80	82	105	94	—16	—10	—14
North Arcot ...	...	26	49	38	53	74	63	—27	—25	—25
South Arcot ...	...	34	60	47	46	70	58	—12	—10	—11
Salem ...	...	20	30	25	37	45	41	—17	—15	—16
Coimbatore ...	...	43	45	44	42	50	46	1	—5	—2
Nilgiris ...	...	249	231	240	31	38	35	218	193	205
Madurai ...	...	55	66	61	49	63	56	6	3	5
Tiruchirapalli ...	...	62	100	81	59	84	71	3	16	10
Thanjavur ...	...	52	64	58	52	65	58	...	—1	...
Ramanathapuram	...	38	55	47	89	94	92	—51	—39	—45
Tirunelveli ...	...	19	25	22	73	62	67	—54	—37	—45
Kanyakumari ...	...	14	15	15	26	25	25	—12	—10	—10
State ...	...	55	68	61	55	68	61	...	...	...

It is seen that the inter-district migration rate for the State is 61 per 1,000 of the State population and the corresponding rates for males and females are 55 and 68 respectively. This gives a picture of the mobility of the State's population from one district to another. Madras has the highest rate of in-migration from other districts with a rate of 259 per 1,000 followed by Nilgiris district with a rate of 240 per thousand persons. In both these districts the rates for males are in excess of the rates for females, and this is mainly due to the migration to these districts in search of employment. Other major inmigrating districts are Tiruchirapalli and Chingleput, but the rate of in-migration to these districts from other districts is hardly one-third of the rate for Madras and Nilgiris districts.

The chief out-migrating districts are Chingleput and Ramanathapuram. Chingleput has a net out-migration to other districts of 94 per 1,000 of its population in 1961 and the rate for females is 105 as against 82 for males. A female excess in the rate of out-migration to other districts is noticed in respect of Ramanathapuram district which has a rate of 94 for females as against 89 for males and 92 for both sexes. Tiruchirapalli and Madras districts stand next with the rates of 71 and 70 respectively per thousand of their populations. The net in-migration is highest in the case of Nilgiris district (205 per thousand) and Madras City stands next with 189 per thousand of the 1961 population. The highest net out-migration is found in respect of Ramanathapuram and Tirunelveli districts (45 per thousand persons).

In the 1961 Census, the information on the number of in-migrants to each district from other districts by duration of migration is available in D-III Tables. But similar information in respect of the out-migrants from each district is not available. This is a major lacuna in the analysis of the data, and it is hoped that in future Censuses such information will be tabulated in greater detail.

However, for the purpose of discussion, we have extracted the available information in respect of in-migrants and presented them in Table 13-7. It is seen that 6.1 lakh males and 6.7 lakh females have moved from their districts of birth. The inward movement has been highest in respect of Madras City, which has received 1.3 lakh males and 1.2 lakh females during the decade. Tiruchirapalli district occupies the next place with 66,000 male and 88,000 female in-migrants during the decade. In the absence of similar information in respect of the out-migrants from each of these districts, it has not been possible to estimate the net migration to each district using the place of birth data.

Rural-urban migration

The 1961 Census has for the first time in Indian Census included a question on rural-urban migration. The question relating to rural-urban migration and instructions for enumeration are follows:

Q. 4 (*b*) *Born R/U:*

(i) If born in a village ... Write R

(ii) If born in a town which is considered a town at the present time even if it was not so considered at the time of birth ... Write U

The place of birth data have been used for working out the life-time as well as intercensal rural-urban migration. By life-time rural-urban migration is meant the totality of rural-urban movement since birth and it does not relate to any specified period.

Life-time rural-urban migration, 1961

The two components of rural-urban migration are (1) rural to urban movement and (2) urban to rural movement and by net rural-urban migration is implied the excess of the former over the latter. The estimate is obtained by adding the number of rural to urban and urban to rural migrants from the same district and other districts of the State. The persons born in rural areas of another State and enumerated in urban areas of the district of enumeration have not been taken into account for working out the rural-urban migration to each district. There are 8.4 lakh males and 9.6 lakh females who are born in rural areas and enumerated in urban areas of the State. The migrants from urban areas to rural areas number 1.9 lakh males and 3.0 lakh females, leaving a net rural-urban migration of 6.5 lakh males and 6.6 lakh females. The life-time urban-ward migration is 183.5 per 1,000 of the urban male population and 217.1 per 1,000 of urban female population of 1961 whereas the rural-ward migration rate is only 40.8 per 1,000 of the 1961 urban male population and 67.3 per 1,000 of the urban female population. The quantum of life-time migration in respect of each district and the respective rates are presented in Tables 13-8 and 13-9 for males and females respectively.

Among males, Coimbatore has the highest net rural-urban migration rate (142.7 per 1,000 of urban male population) followed by Tirunelveli district (163.8 per 1,000 of urban male population) and Madurai district (161.6 per 1,000 of urban male population).

TABLE 13-7

In-migrants to each District from other Districts during 1951-61 based on the Place of Birth Data of 1961 Census

District		Duration of migration: Less than 1 year Males	Less than 1 year Females	1—5 years Males	1—5 years Females	6—10 years Males	6—10 years Females	Total less than 10 years Males	Total less than 10 years Females
Madras	R	...	...	...	...	...	...	...	...
	U	18,107	16,499	65,262	59,413	46,898	46,330	130,267	122,242
	T	18,107	16,499	65.262	59,413	46,898	46,330	130,267	122,242
Chingleput	R	6,722	6,061	13,341	17,072	4,761	9,547	24,824	32,680
	U	6,963	6,784	16,261	16,332	7,233	8,395	30,457	31,511
	T	13,685	12,845	29,602	33,404	11,994	17,942	55,281	64,191
North Arcot	R	2,956	3,525	6,830	12,453	3,432	8,989	13,218	24,967
	U	4,430	3,136	7,277	7,786	3,361	4,213	15,068	15,135
	T	7,386	6,661	14,107	20,239	6,793	13,202	28,286	40,102
South Arcot	R	5,001	4,649	11,577	16,296	4,112	10,935	20,690	31,880
	U	4,660	4,024	9,676	9,687	3,647	4,739	17,983	18,450
	T	9,661	8,673	21,253	25,983	7,759	15,674	38,673	50,330
Salem	R	2,352	3,088	5,860	8,514	3,416	6,561	11,628	18,163
	U	3,662	2,749	6,991	7,161	3,156	3,973	13,809	13,883
	T	6,014	5,837	12,851	15,675	6,572	10,534	25,437	32,046
Coimbatore	R	6,835	4,962	9,072	8,769	2,013	3,582	17,920	17,313
	U	8,494	6,015	22,227	19,123	9,365	9,743	40,086	34,881
	T	15,329	10,977	31,299	27,892	11,378	13,325	58,006	52,194
Nilgiris	R	5,489	3,482	12,696	10,301	6,428	6,202	24,613	19,985
	U	3,177	1,611	5,786	2,345	3,321	2,601	12,284	6,557
	T	8,666	5,093	18,482	12,646	9,749	8,803	36,897	26,542
Madurai	R	3,414	3,788	8,552	11,372	3,946	7,427	15,912	22,587
	U	7,791	6,679	22,003	19,874	11,283	12,442	41,077	38,995
	T	11,205	10,467	30,555	31,246	15,229	19,869	56,989	61,582
Tiruchirapalli	R	5,201	6,910	12,885	21,800	6,930	15,998	25,016	44,708
	U	8,404	7,367	20,815	22,066	12,086	14,197	41,305	43,630
	T	13,605	14,277	33,700	43,866	19,016	30,195	66,321	88,338
Thanjavur	R	10,365	8,724	14,495	17,528	8,520	12,783	33,380	39,035
	U	6,640	5,353	12,500	12,348	6,881	7,619	26,021	25,320
	T	17,005	14,077	26,995	29,876	15,401	20,402	59,401	64,355
Ramanathapuram	R	4,424	4,355	7,163	10,265	2,380	5,975	13,967	20,595
	U	4,207	4,028	10,099	10,861	4,497	5,737	18,803	20,626
	T	8,631	8,383	17,262	21,126	6,877	11,712	32,770	41,221
Tirunelveli	R	1,826	1,919	3,226	4,756	1,306	2,850	6,358	9,525
	U	3,549	2,672	6,177	6,469	2,209	2,989	11,935	12,130
	T	5,375	4,591	9,403	11,225	3,515	5,839	18,293	21,655
Kanyakumari	R	1,145	1,013	1,293	1,359	579	830	3,017	3,202
	U	755	419	1,337	586	410	275	2,502	1,280
	T	1,900	1,432	2,630	1,945	989	1,105	5,519	4,482
State	R	55,730	52,476	106,990	140,485	47,823	91,679	210,543	284,640
	U	80,839	67,336	206,411	194,051	114,347	123,253	401,597	384,640
	T	136,569	119,812	313,401	334,536	162,170	214,932	612,140	669,280

TABLE 13–8

Life-time Rural-Urban Migration in Madras State computed from place of Birth Data, 1961 Census

District	Enumerated Population in 1961		Born in Rural and enumerated in Urban			Born in Urban and enumerated in Rural			Net Rural to Urban migration	Migration Ratio per 1,000 of rural Population			Migration Ratio per 1,000 of urban Population		
	Rural	Urban	Born in rural areas of the same district	Born in rural areas of other districts	Total R→U	Born in Urban areas of the same district	Born in Urban areas of other districts	Total U→R		R→U	U→R	Net	R→U	U→R	Net
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
						MALES									
Madras ...	...	909,701	...	141,642	141,642	...	...	...	141,642	...	...	...	155.7	...	155.7
Chingleput ...	885,478	235,113	29,104	14,700	43,804	8,185	16,150	24,335	19,469	49.5	27.5	22.0	186.3	103.5	82.8
North Arcot ...	1,263,943	317,883	36,306	7,710	44,016	11,268	5,595	16,863	27,153	34.8	13.3	21.5	138.5	53.0	85.4
South Arcot ...	1,337,130	198,798	28,275	10,546	38,821	8,210	8,109	16,319	22,502	29.0	12.2	16.8	195.3	82.1	113.2
Salem ...	1,609,236	314,649	45,146	8,080	53,226	9,981	3,946	13,927	39,299	33.0	8.7	24.4	169.2	44.3	124.9
Coimbatore ...	1,274,800	534,791	99,566	33,363	132,929	15,002	5,349	20,351	112,578	104.3	16.0	88.3	248.6	38.1	210.5
Nilgiris ...	119,287	94,546	2,583	12,904	15,487	1,694	4,602	6,296	9,191	129.8	52.8	77.0	163.8	66.6	97.2
Madurai ...	1,091,964	515,265	58,189	38,719	96,908	9,828	3,812	13,640	83,268	88.7	12.5	76.2	188.1	26.5	161.6
Tiruchirapalli ...	1,244,491	343,938	39,576	32,659	72,235	10,172	6,949	17,121	55,114	58.0	13.8	44.2	210.0	49.8	160.2
Thanjavur ...	1,280,196	330,045	48,939	18,587	67,526	24,605	9,470	34,075	33,451	52.7	26.6	26.1	204.6	103.2	101.4
Ramanathapuram ...	882,147	293,622	28,771	13,912	42,683	6,916	4,403	11,319	31,364	48.4	12.8	35.6	108.4	38.5	69.9
Tirunelveli ...	914,694	415,526	72,361	6,229	78,590	7,584	2,913	10,497	68,093	85.9	11.5	74.4	189.1	25.3	163.8
Kanyakumari ...	428,220	75,515	10,542	2,015	12,557	1,769	531	2,300	10,257	29.3	5.4	23.9	166.3	30.7	135.6
State ...	12,331,586	4,579,392	499,358	341,066	840,424	115,214	71,829	187,043	653,381	68.2	15.2	53.0	183.5	40.8	142.7

TABLE 13-9

Life-time Rural-Urban Migration in Madras State computed from place of Birth Data, 1961 Census

District	Enumerated Population in 1961		Born in Rural and enumerated in Urban			Born in Urban and enumerated in Rural			Net Rural to Urban migration	Migration Ratio per 1,000 of rural Population			Migration Ratio per 1,000 of urban Population		
	Rural	Urban	Born in rural areas of the same district	Born in rural areas of other districts	Total R→U	Born in Urban areas of the same district	Born in Urban areas of other districts	Total U→R		R→U	U→R	Net	R→U	U→R	Net
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
						FEMALES									
Madras ...	...	819,440	...	122,111	122,111	...	...	...	122,111	...	...	...	149.0	...	149.0
Chingleput ...	855,256	220,565	35,270	15,513	50,783	14,371	24,315	38,686	12,097	59.4	45.2	14.2	230.2	175.4	54.8
North Arcot ...	1,251,158	313,342	52,913	7,996	60,909	22,044	10,013	32,057	28,852	48.7	25.6	23.1	194.3	102.3	92.0
South Arcot ...	1,318,521	193,524	39,338	11,192	50,530	13,982	10,872	24,854	25,676	38.3	18.8	19.5	261.1	128.4	132.7
Salem ...	1,577,524	302,699	54,458	8,105	62,563	16,223	5,250	21,473	41,090	39.7	13.6	26.1	206.7	70.9	135.8
Coimbatore ...	1,250,502	497,378	111,978	28,363	140,341	20,255	5,160	25,415	114,926	112.2	20.3	91.9	282.2	51.1	231.1
Nilgiris ...	110,154	85,321	3,353	10,774	14,127	1,345	3,311	4,656	9,471	128.2	42.3	85.9	165.6	54.6	111.0
Madurai ...	1,103,518	500,480	70,248	36,543	106,791	19,105	5,478	24,583	82,208	96.8	22.3	74.5	213.4	49.1	164.3
Tiruchirapalli ...	1,267,516	334,133	51,792	34,078	85,870	17,755	10,564	28,319	57,551	67.7	22.3	45.4	257.0	84.8	172.2
Thanjavur ...	1,304,211	331,475	72,106	16,880	88,986	39,560	13,297	52,857	36,129	68.2	40.5	27.7	268.5	159.5	109.0
Ramanathapuram ...	940,160	305,859	38,467	16,009	54,476	12,541	6,019	18,560	35,916	57.9	19.7	38.2	178.1	60.7	117.4
Tirunelveli ...	967,703	432,356	97,805	6,254	104,059	16,729	4,304	21,033	83,026	107.5	21.7	85.8	240.7	48.6	192.1
Kanyakumari ...	418,616	74,564	14,250	1,733	15,983	3,915	654	4,569	11,414	38.2	10.9	27.3	214.5	61.2	153.3
State ...	12,364,839	4,411,136	641,978	315,551	957,529	197,825	99,237	297,062	660,467	77.4	24.0	53.4	217.1	67.3	149.8

Among females, again Coimbatore has the highest rate of net rural-urban migration *viz.*, 231.1 per 1,000 of the 1961 urban population, followed by the Tirunelveli district which has a rate of 192.1 per 1,000 of the 1961 urban female population. The third place which among males is occupied by Madurai district is taken by the Tiruchirapalli district which has a net rural-urban migration rate of 172.2 per 1,000 of the 1961 urban female population. A synoptic view of the rural-urban migration is presented in Tables 13-10 and 13-11 for males and females separately.

TABLE 13-10

Rural-Urban Migration in 1951-61 in Madras State, computed from the Place of Birth Data, 1961 Census

District	Born in Rural and Enumerated in Urban								Total R→U
	Born in Rural areas of the same district				Born in Rural areas of other districts				
	Less than 1 year	1—5 Years	6—10 Years	Total	Less than 1 Year	1—5 Years	6—10 Years	Total	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MALES									
Madras ...	...	...	...	...	10,143	37,402	27,795	75,340	75,340
Chingleput ...	3,672	9,724	5,677	19,073	2,453	5,463	2,550	10,466	29,539
North Arcot ...	5,127	11,936	6,712	23,775	2,099	2,443	1,171	5,713	29,488
South Arcot ...	4,619	10,382	4,496	19,497	2,256	4,250	1,620	8,126	27,623
Salem ...	6,629	15,416	8,122	30,167	1,364	2,712	1,250	5,326	35,493
Coimbatore ...	10,299	29,238	19,582	59,119	4,652	11,701	5,355	21,708	80,827
Nilgiris ...	736	932	311	1,979	1,968	3,620	2,506	8,094	10,073
Madurai ...	6,780	19,255	9,931	35,966	4,396	12,192	6,602	23,190	59,156
Tiruchirapalli ...	5,129	13,905	7,245	26,279	4,220	10,702	6,629	21,551	47,830
Thanjavur ...	6,750	16,765	8,157	31,672	3,291	5,712	3,245	12,248	43,920
Ramanathapuram ...	3,895	10,930	5,392	20,217	1,979	5,001	2,520	9,500	29,717
Tirunelveli ...	9,056	23,463	12,778	45,297	1,626	2,234	708	4,568	49,865
Kanyakumari ...	1,389	3,966	1,603	6,958	429	796	276	1,501	8,459
State ...	64,081	165,912	90,006	319,999	40,876	104,228	62,227	207,331	527,330

TABLE 13-10—(*Contd.*)

Rural-Urban Migration in 1951-61 in Madras State, computed from the Place of Birth Data, 1961 Census—(*Contd.*)

District		Born in Urban and enumerated in Rural								Total U→R	Net Rural to Urban Migration
		Born in Urban areas of the same district				Born in Urban areas of other districts					
		Less than 1 Year	1—5 Years	6—10 Years	Total	Less than 1 Year	1—5 Years	6—10 Years	Total		
		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
					MALES—(*Contd.*)						
Madras	...	...	...	...	...	...	...	...	...	...	75,340
Chingleput	...	1,413	3,338	1,389	6,140	3,348	7,042	2,373	12,763	18,903	10,636
North Arcot	...	2,299	4,250	1,761	8,310	1,075	2,096	874	4,045	12,355	17,133
South Arcot	...	1,684	3,452	1,165	6,301	1,700	4,028	873	6,601	12,902	14,721
Salem	...	1,945	4,060	1,707	7,712	772	1,557	661	2,990	10,702	24,791
Coimbatore	...	3,262	5,974	2,347	11,583	1,912	2,433	459	4,804	16,387	64,440
Nilgiris	...	449	879	190	1,518	976	2,264	607	3,847	5,365	4,708
Madurai	...	1,848	4,613	1,538	7,999	741	1,671	618	3,030	11,029	48,127
Tiruchirapalli	...	1,744	3,903	1,692	7,339	1,114	2,778	1,275	5,167	12,506	35,324
Thanjavur	...	4,030	9,584	4,280	17,894	2,020	3,264	1,757	7,041	24,935	18,985
Ramanathapuram	...	1,707	2,964	1,007	5,678	1,241	2,047	500	3,788	9,466	20,251
Tirunelveli	...	1,625	3,108	1,244	5,977	736	1,270	437	2,443	8,420	41,445
Kanyakumari	...	336	641	278	1,255	193	193	79	465	1,720	6,739
State	...	22,342	46,766	18,598	87,706	15,828	30,643	10,513	56,984	144,690	382,640

TABLE 13-11

Rural-Urban Migration in 1951-61 in Madras State, computed from the Place of Birth Data, 1961 Census

District		Born in Rural and enumerated in Urban								Total R→U
		Born in Rural areas of the same district				Born in Rural areas of other districts				
		Less than 1 year	1—5 Years	6—10 Years	Total	Less than 1 Year	1—5 Years	6—10 Years	Total	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
					FEMALES					
Madras	...	...	...	...	...	8,826	33,363	27,366	69,555	69,555
Chingleput	...	3,174	10,270	6,824	20,268	2,008	5,332	2,734	10,074	30,342
North Arcot	...	4,336	14,596	10,374	29,306	1,010	2,405	1,399	4,814	34,120
South Arcot	...	4,155	11,374	7,125	22,654	1,555	3,860	2,007	7,422	30,076
Salem	...	5,718	16,307	10,503	32,528	883	2,534	1,475	4,892	37,420
Coimbatore	...	9,720	31,753	22,342	63,815	2,854	9,651	5,567	18,072	81,887
Nilgiris	...	390	899	442	1,731	886	1,324	1,634	3,844	5,575
Madurai	...	6,132	20,690	13,556	40,378	3,346	10,508	7,129	20,983	61,361
Tiruchirapalli	...	3,884	14,563	10,136	28,583	3,453	10,353	7,209	21,015	49,598
Thanjavur	...	6,830	21,361	13,009	41,200	2,241	4,942	3,453	10,636	51,836
Ramanathapuram	...	4,042	11,204	7,044	22,290	1,721	4,990	3,134	9,845	32,135
Tirunelveli	...	9,184	27,597	17,006	53,787	918	2,150	1,021	4,089	57,876
Kanyakumari	...	1,427	3,985	2,392	7,804	419	586	219	1,224	9,028
State	...	58,992	184,599	120,753	364,344	30,120	91,998	64,347	186,465	550,809

TABLE 13-11—(*Contd.*)

Rural-Urban Migration in 1951-61 in Madras State, computed from the Place of Birth Data, 1961 Census—(*Contd.*)

District		Born in Urban and enumerated in Rural								Total U→R	Net Rural to Urban migration
		Born in Urban areas of the same district				Born in Urban areas of other districts					
		Less than 1 Year	1—5 Years	6—10 Years	Total	Less than 1 Year	1—5 Years	6—10 Years	Total		
		(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)
						FEMALES—(*Contd.*)					
Madras	...	...	...	...	...	...	...	...	...	...	69,555
Chingleput	...	1,637	4,453	2,446	8,536	3,305	8,808	4,164	16,277	24,813	5,529
North Arcot	...	2,240	6,169	3,822	12,231	1,148	3,065	1,716	5,929	18,160	15,960
South Arcot	...	1,485	4,406	2,353	8,244	1,488	4,162	1,728	7,378	15,622	14,454
Salem	...	2,062	5,175	2,781	10,018	763	1,718	902	3,383	13,401	24,019
Coimbatore	...	3,246	6,724	3,346	13,316	1,287	2,178	626	4,091	17,407	64,480
Nilgiris	...	310	680	157	1,147	566	1,604	490	2,660	3,807	1,768
Madurai	...	2,365	6,373	3,372	12,110	841	2,016	918	3,775	15,885	45,476
Tiruchirapalli	...	1,991	5,441	3,033	10,465	1,247	3,407	2,011	6,665	17,130	32,468
Thanjavur	...	4,106	12,378	7,502	23,986	1,918	4,111	2,630	8,659	32,645	19,191
Ramanathapuram	...	1,750	4,125	2,017	7,892	1,030	2,386	897	4,313	12,205	19,930
Tirunelveli	...	2,020	4,793	2,800	9,613	761	1,482	695	2,938	12,551	45,325
Kanyakumari	...	478	1,014	586	2,078	188	204	70	462	2,540	6,488
State	...	23,690	61,731	34,215	119,636	14,542	35,141	16,847	66,530	186,166	364,643

The rural to urban migration rate for Madras City is low when compared to the State average and is perhaps indicative of a state of saturation in 'attraction' offered by the City. Further, this is also due to the spread of industrialisation to other areas which has led to a growth of industrial towns in districts like Coimbatore, Madurai and Tirunelveli which offer considerable 'attraction' to migrants from surrounding rural areas. The role of the push and pull factors in urban-ward migration emphasised in the demographic and sociological literature of the west is yet to be examined in detail in the Indian situation. This will require a follow up of a group of migrants and analyse their motivations for such migration. This is perhaps a vast field of study that can be contemplated and future Censuses will do well to conduct special enquiries on this subject.

But, for the present study, we may pass over to the subject of intercensal rural-urban migration with the observation that life-time concept of migration is inadequate to understand the phenomenon of rural-urban migration. The special migration tables of Madras State have been used for computing intercensal rural-urban migration estimates presented in Table 13-12. There are 527,330 males and 550,809 females who have migrated from rural to urban areas during the period 1951-60. During the same period, 144,690 males and 186,166 females have migrated from urban to rural areas, leaving a net rural to urban migration of 382,640 males and 364,643 females. This constitutes 105 per 1,000 of the 1951 urban population. A synoptic picture of the rural-urban migration in different districts can be had from Table 13-12.

TABLE 13-12

Rural-Urban Migration Rate in 1951-61, computed from the Place of Birth Data, 1961 Census

District		Enumerated population in 1951		Rural to urban migration in 1951-61	Urban to rural migration in 1951-61	Net migration	Rate per 1,000 of rural population			Rate per 1,000 of urban population		
		Rural	Urban				R→U	U→R	Net	R→U	U→R	Net
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
						MALES						
Madras	...	...	737,013	75,340	...	75,340	...	...	...	...	...	102.22
Chingleput	...	820,871	172,077	29,539	18,903	10,636	35.98	23.03	12.95	171.66	109.85	61.81
North Arcot	...	1,186,352	261,584	29,488	12,355	17,133	24.86	10.41	14.45	112.73	47.23	65.50
South Arcot	...	1,226,596	163,867	27,623	12,902	14,721	22.52	10.52	12.00	168.57	78.73	89.84
Salem	...	1,453,187	237,435	35,493	10,702	24,791	24.42	7.36	17.06	149.49	45.07	104.42
Coimbatore	...	1,256,920	326,084	80,827	16,387	64,440	64.31	13.04	51.27	247.87	50.25	197.62
Nilgiris	...	116,814	47,066	10,073	5,365	4,708	86.23	45.93	40.30	214.02	113.99	100.03
Madurai	...	1,033,275	405,983	59,156	11,029	48,127	57.25	10.67	46.58	145.71	27.17	118.54
Tiruchirapalli	...	1,167,583	292,073	47,830	12,506	35,324	40.96	10.71	30.25	163.76	42.82	120.94
Thanjavur	...	1,182,224	285,290	43,920	24,935	18,985	37.15	21.09	16.06	153.95	87.40	66.55
Ramanathapuram	...	740,102	256,065	29,717	9,466	20,251	40.15	12.79	27.36	116.05	36.97	79.08
Tirunelveli	...	867,785	350,107	49,865	8,420	41,445	57.46	9.70	47.76	142.43	24.05	118.38
Kanyakumari	...	358,822	58,549	8,459	1,720	6,739	23.57	4.79	18.78	144.48	29.38	115.10
State	...	11,410,531	3,593,193	527,330	144,690	382,640	46.21	12.68	33.53	146.76	40.27	106.49

TABLE 13-12—(*Contd.*)

Rural-Urban Migration Rate in 1951-61, computed from the Place of Birth Data, 1961 Census—(*Contd.*)

District	Enumerated population in 1951		Rural to urban migration in 1951-61	Urban to rural migration in 1951-61	Net migration	Rate per 1,000 of rural Population			Rate per 1,000 of urban Population		
	Rural	Urban				R→U	U→R	Net	R→U	U→R	Net
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
					FEMALES						
Madras ...	...	679,043	69,555	...	69,555	...	...	...	...	...	102.43
Chingleput ...	797,728	167,414	30,342	24,813	5,529	38.04	31.10	6.94	181.24	148.21	33.03
North Arcot ...	1,185,028	266,628	34,120	18,160	15,960	28.79	15.32	13.47	127.97	68.11	59.86
South Arcot ...	1,222,708	163,596	30,076	15,622	14,454	24.60	12.78	11.82	183.84	95.49	88.35
Salem ...	1,446,468	233,884	37,420	13,401	24,019	25.87	9.26	16.61	159.99	57.30	102.69
Coimbatore ...	1,263,184	308,108	81,887	17,407	64,480	64.83	13.78	51.05	265.77	56.50	209.27
Nilgiris ...	105,918	41,931	5,575	3,807	1,768	52.64	35.94	16.70	132.96	90.79	42.17
Madurai ...	1,053,238	399,321	61,361	15,885	45,476	58.26	15.08	43.18	153.66	39.78	113.88
Tiruchirapalli ...	1,198,519	285,662	49,598	17,130	32,468	41.38	14.29	27.09	173.62	59.97	113.65
Thanjavur ...	1,222,595	292,606	51,836	32,645	19,191	42.40	26.70	15.70	177.15	111.57	65.58
Ramanathapuram ...	811,874	273,750	32,135	12,205	19,930	39.58	15.03	24.55	117.39	44.58	72.81
Tirunelveli ...	919,874	367,237	57,876	12,551	45,325	62.92	13.64	49.28	157.60	34.18	123.42
Kanyakumari ...	350,411	58,598	9,028	2,540	6,488	25.76	7.25	18.51	154.07	43.35	110.72
State ...	11,577,545	3,537,778	550,809	186,166	364,643	47.58	16.08	31.50	155.69	52.62	103.07

Among males, the rate of net migration is highest in Coimbatore district, 197 per 1,000 of the 1951 urban population, followed by Madurai, Tirunelveli and Kanyakumari districts. The net in-migration is the least in respect of Chingleput district, (61.81 per 1,000 males and 33.03 per 1,000 females) and North Arcot occupies the next position with a low rate of net migration. Among females, Nilgiris has a verv low rate (42.13 per 1,000) of net migration.

Alternative methods of estimating rural-urban migration

The Census Survival Ratio method cannot be applied in the case of urban-ward migration in India. This is because the relevant age data for 1941 are not available. While the net rural-urban migration cannot be estimated for each age group, it is possible to estimate the total net migration for all ages 10 and above. There are two methods, *viz.*, (1) Short Forward Survival Ratio Method, (2) Reverse Survival Ratio Method.

The "short method" consists in computing an overall survival ratio for the country as a whole and applying it to the total urban population in 1941 to get the expected population in 1951. This when subtracted from the total population 10 years and above enumerated in the same area in 1951 will yield an estimate of net migration to this area during the decade 1941-51 among persons aged 10 years and above in 1951. Symbolically if P_0^{41} represents the total urban population in 1941, P_{10+}^{51} the total urban population aged 10 and above in 1951 and S the overall survival ratio $\left(\frac{T_{10}}{T_0}\text{ in life table terminology}\right)$ then, an estimate of the volume of net migration is given by

$$P_{10+}^{51} - P_{0+}^{41} \times S$$

and the rate of migration by $\dfrac{P_{10+}^{51}}{P_{0+}^{41}} - S$

The reverse method can also be applied to get an estimate of total net migration. For any particular age group (x, x+5), the migration estimates obtained by the forward and reverse methods are related by the equation M_x (forward)$=S_x M_x$ (reverse) where S_x is the forward survival ratio at age x.

$$M_x \text{ (forward) } = S_x M_x \text{ (reverse)}$$
$$= S_c M_x \text{ (reverse)}$$

where c is some unknown age above 10 years and x varies from 10 to the highest age. An approximate estimate of S_c is obtained by dividing the total population 10 and above in 1951 in India after adjusting for international migration by the total population in 1941. M_x (reverse) can be computed from available data and therefore an estimate of M_x (forward) can be obtained. In general the reverse method gives estimates of migration nearer to the true value whereas the short method under-estimates migration to urban areas.

Modified short method: Zachariah has shown that the defect in the short method can be removed by finding a suitable correction factor. He has derived a correction factor by the following elaborate procedure. It was found that the "Short Method" is as efficient as the detailed Forward Survival Ratio method for areas where the percentage age distribution for 1941 is the same as the all India age distribution. Thus, the error in the short method depends on the difference between the percentage age distribution for the urban area and the country. For most of the districts in India, the detailed 5-year age data are available both for 1941 and 1951. Therefore, it is possible to estimate the expected population in 1951 for each of these districts by both the detailed and short method. If E_1 and E_2 are the expected population obtained by the detailed and short method respectively $F=\frac{E_1}{E_2}$ is the correction factor.

The correction factor for males was obtained by Zachariah from the following multiple regression equation.

$$x=0.0516y + 113.5085z + 309.3898p - 13553.4656$$

where $x=\left(\frac{E_1}{E_2}\right)10{,}000$

$$y=\frac{\text{Total males in 1941}}{\text{Total females in 1941}} \times 1{,}000$$

$$z=\frac{\text{Total males less than 15 in 1951}}{\text{Total males in 1951}} \times 100$$

$$p=\frac{\text{Total males 15–34 in 1951}}{\text{Total males in 1951}} \times 100$$

For females, a different procedure was adopted. For the State as a whole the estimate made by "Reverse Method" was assumed to be the best. If m_i is the migration estimate for the 'i'th district by the short method and M the estimate for the State by the reverse method, then $\frac{M}{\Sigma m_i}$ is the correction factor and the corrected estimate for the 'i'th district is given by $m_i \times \frac{M}{\Sigma m_i}$ where the summation extends over all the districts in the State.

The following table gives the volume and rate of rural-urban migration among persons aged 10 and above.

TABLE 13-13

Net Migration to metropolitan Cities, 1941-51

From Graduated age data

Age as on Census day 1951		Volume of Migration (in thousands)							
		Bombay		Madras		Delhi		Calcutta	
		Males	Females	Males	Females	Males	Females	Males	Females
10—14	...	+ 66.3	+ 41.0	+ 38.6	+ 36.6	+ 34.2	+ 24.8	+ 45.4	+ 39.7
15—19	...	+ 116.1	+ 52.9	+ 44.5	+ 33.9	+ 39.1	+ 30.7	+ 89.9	+ 39.7
20—24	...	+ 165.8	+ 61.7	+ 39.4	+ 23.3	+ 34.7	+ 24.1	+ 96.2	+ 26.1
25—29	...	+ 152.8	+ 49.6	+ 34.4	+ 20.5	+ 21.3	+ 17.1	+ 55.7	+ 14.7
30—34	...	+ 81.6	+ 20.6	+ 23.9	+ 19.0	+ 8.2	+ 13.0	— 7.4	+ 7.8
35—39	...	+ 28.1	+ 6.2	+ 15.5	+ 17.8	+ 6.4	+ 9.6	— 32.2	+ 5.9
40—44	...	+ 5.5	+ 4.6	+ 12.8	+ 17.0	+ 10.2	+ 8.2	— 25.4	+ 3.6
45—49	...	— 3.0	+ 5.5	+ 10.4	+ 15.0	+ 10.3	+ 8.7	— 19.3	+ 1.9
50—54	...	— 0.7	+ 6.3	+ 8.7	+ 13.6	+ 6.8	+ 7.4	— 13.2	+ 2.8
55—59	...	+ 1.0	+ 5.1	+ 7.5	+ 12.4	+ 5.4	+ 4.9	— 7.6	+ 3.0
60+	...	— 5.6	+ 5.0	+ 16.2	+ 25.7	+ 2.9	+ 1.3	— 13.5	— 1.3
Total 10+	...	+ 607.9	+ 258.7	+ 251.8	+ 234.9	+ 179.7	+ 150.1	+ 168.6	+ 143.8

Source : K. C. Zachariah, Internal Migration in India, 1941-51, (Mimeographed), p. 152.

TABLE 13-14

Net migration to Metropolitan Cities, 1941-51 (Rate)

From Graduated age data

Age as on Census day 1951		Bombay		Madras		Delhi		Calcutta	
		Males	Females	Males	Females	Males	Females	Males	Females
		Volume of migration under 10 years (in thousands)							
0— 9	...	+ 87.1		+ 53.2		+ 75.8		+38.6	
		Rate of migration (per 100 average population)							
10—14	...	+ 59.32	+ 46.69	+ 60.84	+ 60.97	+ 57.65	+ 52.10	+ 36.36	+ 44.43
15—19	...	+ 83.85	+ 60.41	+ 72.16	+ 59.92	+ 66.41	+ 67.91	+ 55.08	+ 46.11
20—24	...	+ 91.97	+ 63.67	+ 66.78	+ 44.71	+ 58.92	+ 58.56	+ 48.60	+ 31.96
25—29	...	+ 79.22	+ 53.38	+ 60.73	+ 42.25	+ 39.76	+ 47.97	+ 27.34	+ 19.95
30—34	...	+ 48.78	+ 27.85	+ 47.93	+ 44.95	+ 18.51	+ 44.49	— 4.14	+ 12.34
35—39	...	+ 21.31	+ 11.25	+ 37.61	+ 50.30	+ 17.75	+ 42.67	— 22.63	+ 11.36
40—44	...	+ 5.62	+ 11.24	+ 37.63	+ 57.27	+ 33.48	+ 46.53	— 23.64	+ 8.70
45—49	...	— 4.40	+ 17.64	+ 37.95	+ 61.05	+ 42.17	+ 58.80	— 24.85	+ 6.01
50—54	...	— 1.55	+ 26.49	+ 41.48	+ 68.29	+ 38.51	+ 64.88	— 25.04	+ 10.80
55—59	...	+ 3.35	+ 29.47	+ 48.87	+ 79.17	+ 43.78	+ 62.81	— 22.54	+ 15.30
60+	...	— 16.36	+ 18.28	+ 62.93	+ 90.50	+ 19.08	+ 15.77	— 30.05	— 3.80

Source : K. C. Zachariah, Internal Migration in India, 1941-51 (Mimeographed), Page 152.

TABLE 13-15

Net Migration to Metropolitan Cities, 1941-51 (figures in thousands)

From Ungraduated age data

Age as on Census day 1951		Bombay		Madras		Delhi		Calcutta	
		Males	Females	Males	Females	Males	Females	Males	Females
10—14	...	+ 50.8	+ 32.6	+ 41.9	+ 45.7	+ 32.8	+ 24.2	+ 28.4	+ 38.0
15—19	...	+ 107.6	+ 52.2	+ 47.2	+ 32.5	+ 38.9	+ 35.5	+ 111.2	+ 47.3
20—24	...	+ 203.1	+ 76.4	+ 43.2	+ 25.9	+ 46.1	+ 27.5	+ 115.2	+ 29.6
25—29	...	+ 162.5	+ 52.9	+ 32.7	+ 14.6	+ 13.1	+ 10.7	+ 51.5	+ 8.2
30—34	...	+ 62.9	+ 6.1	+ 22.1	+ 18.3	+ 3.1	+ 13.4	— 36.8	— 1.5
35—39	...	+ 17.9	+ 3.7	+ 9.4	+ 13.8	+ 2.3	+ 6.7	— 48.6	+ 7.9
40—44	...	— 2.5	+ 1.5	+ 15.2	+ 19.9	+ 11.0	+ 7.8	— 25.5	— 0.2
45—49	...	— 10.3	+ 4.6	+ 6.2	+ 11.1	+ 11.5	+ 8.5	— 27.4	+ 0.3
50—54	...	— 1.7	+ 7.3	+ 10.3	+ 16.2	+ 4.3	+ 9.0	— 12.6	+ 3.6
55—59	...	+ 2.2	+ 4.7	+ 6.2	+ 10.8	+ 5.5	+ 3.1	— 9.1	+ 2.7
60—64	...	— 2.8	+ 3.5	+ 6.8	+ 12.7	+ 6.2	+ 4.9	— 2.8	+ 4.0
65—69	...	+ 1.3	+ 2.8	+ 2.3	+ 3.4	+ 5.2	+ 2.4	— 4.6	— 1.3
70+	...	— 0.5	+ 2.1	+ 6.7	+ 10.6	+ 6.8	+ 7.1	+ 0.7	+ 3.9
Total	...	+ 590.5	+ 250.6	+ 250.2	+ 235.6	+ 186.8	+ 160.9	+ 139.7	+ 142.8

Source: K. C. Zachariah, Internal Migration in India, 1941-51 (Mimeographed), Page 152.

TABLE 13-16

Rural-Urban migration in Madras and Coorg, 1941-51

		Volume of net migration in thousands	Rate of net migration per 100 persons in 1941
Males	...	856.6	20.80
Females	...	883.0	21.56
Persons	...	1,739.6	21.18

Source: K. C. Zachariah, Internal Migration in India, p. 30.

During the decade under consideration, the largest migration has been to Madras. The migration of males and females to urban areas seems to be more or less balanced. While these estimates relate to Madras and Coorg, a fairly good picture of the level and variation of the rate of migration to urban areas of various districts in the present Madras State can be obtained from the following table.

TABLE 13-17

Rural-Urban migration by districts, present Madras State, 1941-51

District		Rural-urban migration: Volume		Rural-urban migration: Rate per 100 of 1941 population	
		Males	Females	Males	Females
Madras	...	+248,377	+242,080	+60.95	+65.43
Chingleput	...	+20,995	+22,326	+17.05	+18.68
North Arcot	...	+24,167	+32,105	+11.71	+15.53
Salem	...	+42,637	+46,100	+25.79	+28.67
Coimbatore	...	+64,597	+54,939	+28.72	+25.18
South Arcot	...	+12,566	+12,739	+ 9.32	+ 9.42
Thanjavur	...	+37,728	+42,349	+17.18	+18.71
Tiruchirapalli	...	+26,917	+26,764	+11.87	+11.82
Madurai	...	+55,732	+53,710	+18.73	+17.96
Ramanathapuram	...	+19,151	+24,279	+8.70	+10.34
Tirunelveli	...	+35,154	+41,035	+11.82	+13.13
Nilgiris	...	+4,327	+4,443	+11.91	+14.11

Source: K. C. Zachariah, Internal Migration in India, page 146-147.

Madras City is among the first ten districts in India experiencing a high rate of migration, the rate of migration being 61% among males and 65% among females. Ramanathapuram district is one of the districts experiencing the least urban-ward migration, the rates of in-migration being 9% among males and 10% among females. In three districts *viz.*, Madras, Coimbatore and Madurai, migration among persons aged 10 years and above exceeded 100,000.

Net migration to Madras City, 1941-51

The net migration to Madras City in 1941-51 estimated by Zachariah by three different methods are given below.

TABLE 13-18

Net migration to Madras City, 1941-51

Method	Volume (000)	Rate (%)
(1) Short survival ratio method ...	525.5	67.6
(2) Detailed survival ratio method		
(*a*) ungraduated data ...	520.8	67.0
(*b*) graduated data ...	539.9	69.5

Source: K. C. Zachariah, Internal Migration in India, 1941-51, page 36.

The above figures include the migrants under 10 years of age obtained by the child-woman ratio method. Even though these three methods do not give exactly the same figures, they do indicate the magnitude of net migration into Madras City. It is interesting to examine the composition of population of Madras City according to place of birth. Only 59% of those enumerated in Madras City in 1951 were born in Madras City itself, and about 3% were born in other States.

Age-sex distribution of migrants to Madras City, 1941-50

The migration estimates by age and sex for 1941-51 derived by the Survival Ratio Method separately for graduated and ungraduated age data are presented in Table 13-19.

TABLE 13-19

Net migration to Madras City, 1941-51, from graduated and ungraduated Data

Age Group	Volume of migration (in thousands)			
	Ungraduated data		Graduated data	
	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)
10—14 ...	41.9	45.7	38.6	36.6
15—19 ...	47.2	32.5	44.5	33.9
20—24 ...	43.2	25.9	39.4	23.3
25—29 ...	32.7	14.6	34.4	20.5
30—34 ...	22.1	18.3	23.9	19.0
35—39 ...	9.4	13.8	15.5	17.8
40—44 ...	15.2	19.9	12.8	17.0
45—49 ...	6.2	11.1	10.4	15.0
50—54 ...	10.3	16.2	8.7	13.6
55—59 ...	6.2	10.8	7.5	12.4
60+ ...	15.8	26.7	16.2	25.7
Total 10+ ...	250.2	235.6	251.8	234.9

Estimation of the number of urban-ward migrants in 1951-61 by Short Survival Ratio Method

Since the urban area as defined in 1951 and 1961 are different and our object is to find the rural to urban migration rate (and not the degree of urbanisation), we found it necessary to adjust the 1951 figures of urban population so as to be on a par with that of 1961. This was done by adding to the urban population of 1951, the population of the towns newly added in 1961 and deducting the population of those towns which were declassified in 1961. The survival ratios for males and females were computed from Shri Jain's Life Table for 1951-60 for India.

Using the short survival ratio method described above we have obtained the estimates of urban-ward migration in the 1951-61 decade. The results are set out in Table 13-20. This method gives a total net urban-ward migration of 410,485 persons consisting of 242,323 males and 168,162 females. The rates per thousand of the 1951 male and female population are found to be 63 for males and 44 for females respectively. For both sexes the rate works out to 53 per thousand of the 1951 urban population.

TABLE 13-20

Estimation of Number of Urban-ward Migrants in 1951-61 by short survival ratio method

District		Urban Population (1951)		Urban Population 1961 aged 10+		Estimated Survivors to 1951 Population *		Urban-ward Migration		Rate of urban-ward migration in 1951–61 per 1,000 of 1951 Population	
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Madras	...	737,013	679,043	685,428	601,233	598,261	546,865	87,167	54,368	118	80
Chingleput	...	190,467	185,090	175,212	161,553	154,608	149,061	20,604	12,492	108	67
North Arcot	...	285,456	289,036	231,286	226,915	231,715	232,774	—429	—5,859	—2	—20
South Arcot	...	167,942	167,882	145,965	140,806	136,324	135,202	9,641	5,604	57	33
Salem	...	258,802	254,898	228,236	218,434	210,078	205,281	18,158	13,153	70	52
Coimbatore	...	420,974	395,608	395,760	359,961	341,719	318,601	54,041	41,360	128	105
Nilgiris	...	81,288	70,953	68,400	59,236	65,984	57,141	2,416	2,095	30	30
Madurai	...	423,785	417,493	375,581	363,245	344,002	336,226	31,579	27,019	75	65
Tiruchirapalli	...	298,406	291,617	257,396	248,093	242,226	234,853	15,170	13,240	51	45
Thanjavur	...	299,596	307,378	246,213	247,725	243,192	247,546	3,021	179	10	1
Ramanathapuram	...	265,921	283,797	213,908	228,047	215,857	228,554	—1,949	—507	—7	—2
Tirunelveli	...	356,169	378,762	307,919	326,140	289,115	305,034	18,804	21,106	53	56
Kanyakumari	...	87,874	88,066	55,430	54,836	71,330	70,924	—15,900	—16,088	—181	—183
State	...	3,873,693	3,809,623	3,386,734	3,236,224	3,144,411	3,068,062	242,323	168,162	63	44

* Obtained by applying the following survival ratios for India from Shri Jain's Life Table for 1951–61.
Males : **0.811735.** Females : **0.805345.**

It is interesting to examine the trends in urban-ward migration by districts. Among males, the rate is highest in respect of Coimbatore district (128 per 1,000 males), followed by Madras City (118 per 1,000 males) and Chingleput (108 per 1,000 males). Among females the highest net rate is found in respect of Coimbatore district (105 per 1,000 females) followed by Madras City (80 per 1,000 females) and Chingleput district (67 per 1,000 females).

We actually find a net rural-ward migration in respect of Kanyakumari, Ramanathapuram and North Arcot districts. This is a bit baffling since this is contrary to the general tendency in recent times which is for the population to move towards urban areas from rural areas in search of livelihood. The rural-ward migration is quite striking in the case of Kanyakumari district where 181 out of every 1,000 urban males in 1951 have moved to rural areas and an even greater number of females (18.3 per 1,000 females) have followed suit. Since we have already made adjustment for the declassification of certain towns in this district, this clearly indicates a rural-ward trend in the movement of population in Kanyakumari district. Our enquiries reveal that a process of suburbanisation is taking place in this district and people tend to move to places one or two

miles away from the towns, since the atmosphere in these places is more congenial to a healthy life. It is however difficult to estimate the quantum of suburbanisation taking place in this district. In the case of Ramanathapuram and North Arcot districts this can be attributed to a rapid rural development that has taken place during the last decade consequent on the extension of the community development programme even to the remotest areas of these districts.

Estimation of migration to Madras City by Census Survival Ratio Method

The Census Survival Ratio method has been adopted for working out the migration estimates for Madras City for 1921-31, 1931-41 and 1951-61 decades. These together with similar estimates by Zachariah for 1941-51 enable a comparative study of the migration trends during the last four decades. The estimates have been computed with ungraduated age data available by the conventional age groups. The age-sex distributions of Madras City for 1921, 1931, 1941, 1951 and 1961 are presented in Table 13-21 and the Census Survival Ratios are shown in Table 13-22. The Census Survival Ratios are computed from the age-sex distribution for India, after adjusting for errors in age reporting as described in Appendix.

TABLE 13-21

Age-Sex Distribution for Madras City, 1921-61

Age Group	1921		1931		1941		1951		1961	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0— 4 ...	29,753	30,358	42,474	42,385	52,891	49,928	66,284	63,208	115,854	113,073
5— 9 ...	31,613	31,846	40,305	38,537	55,270	53,786	71,114	64,030	108,419	105,134
10—14 ...	30,907	27,033	38,338	36,561	47,115	48,226	91,661	87,898	94,676	89,243
15—19 ...	27,785	28,338	38,196	38,355	43,265	46,637	83,087	66,944	73,859	75,817
20—24 ...	31,261	31,518	41,911	40,913	47,682	46,410	75,214	65,137	96,714	88,832
25—29 ...	32,537	29,825	39,454	36,690	47,342	40,963	75,046	61,726	91,333	85,208
30—34 ...	30,398	26,666	36,064	29,293	40,773	32,907	66,313	57,990	75,725	62,195
35—39 ...	22,931	16,184	31,332	23,233	36,469	28,368	45,282	41,350	66,579	49,069
40—44 ...	22,489	19,305	24,533	18,077	28,314	21,673	46,626	43,858	55,083	39,812
45—49 ...	13,984	10,232	18,313	13,849	21,859	17,929	31,788	30,010	41,375	30,423
50—54 ...	14,380	12,992	12,640	10,427	15,290	12,368	30,988	31,868	34,575	28,618
55—59 ...	6,708	4,900	9,332	7,856	10,986	8,737	18,552	20,812	19,891	16,329
60—64 ...	7,640	6,829	6,115	5,009	6,682	5,560	15,973	21,096	18,150	17,536
65—69 ...	2,373	1,798	3,093	2,490	3,284	2,950	7,666	8,233	7,504	7,115
70+— ...	4,707	4,246	4,216	3,561	4,304	3,517	11,419	14,883	9,863	10,964
All Ages ...	309,466	282,070	386,316	347,236	461,526	419,959	737,013	679,043	909,600	819,368

TABLE 13-22

Census Survival Ratio for 1921-31, 1931-41 and 1951-61

Age Group	1921-31		1931-41		1951-61	
	Males	Females	Males	Females	Males	Females
0— 4 to 10—14	.88803	.82686	.81792	.74774	.96096	.91796
5— 9 to 15—19	.80597	.81496	.79091	.77585	.86933	.84813
10—14 to 20—24	.82355	.93247	.81155	.88034	.85199	.91259
15—19 to 25—29	1.02372	1.09282	.95303	.97851	.99258	1.02625
20—24 to 30—34	1.05519	.97601	.96939	.91908	1.03337	.97358
25—29 to 35—39	.87982	.79099	.88441	.83442	.93577	.85694
30—34 to 40—44	.76788	.71186	.83557	.81166	.87421	.81624
35—39 to 45—49	.71250	.68206	.82154	.81450	.84353	.80943
40—44 to 50—54	.65019	.64042	.79526	.80325	.79111	.77270
45—49 to 55—59	.58994	.61325	.73068	.75762	.71473	.71889
50—54 to 60—64	.52127	.56324	.70443	.75408	.66587	.70246
55—59 to 65—69	.45669	.47756	.72294	.77013	.59826	.62858
60+ to 70+	.27922	.28126	.46883	.50213	.39720	.41444

The results of our computation are presented in Table 13-23 together with the estimate of Zachariah for 1941-51. The Census Survival Ratio Method does not enable the estimation of the migrants in 0-4 and 5-9 age groups. This was done by the child woman ratio method *viz.*, by applying the child woman ratios (children aged 0-4 to women aged 15-44 and children aged 5-9 to women aged 20-49) to the appropriate female migrants. For the decade 1941-51, Zachariah has not presented the estimated migrants separately for 0-4 and 5-9 age groups and for either sex and we have broken up the estimate by adopting the proportion of males and females in these age groups in 1941.

The trend in the migration to Madras City is interesting. The decade 1921-31 stands out as a decade of a high rate of net in-migration, the rates being 190 for males and 152 for females per thousand males and females respectively. In 1931-41, the rate of migration appears to have dampened, the migration rate having fallen to 85 for males as well as females. This slowing down of the rate of migration to Madras City can be explained by the scare of the Second World War which led to large scale evacuation of certain areas of Madras City, apart from serving as a disincentive to further development.

Coming on the aftermath of the war and the restoration of normal conditions, Madras City grew rapidly in the 1941-51 decade and there was considerable movement of population from other districts to the City. This is very well reflected by the high rate of net in-migration recorded for this decade—546 for males and 559 for females. Incidentally, this is the highest rate ever recorded in the last four decades and this City ward movement of population has also been helped by the emphasis placed on industrialisation after independence. This is examined in greater detail in our report on the metropolitan City of Madras.

The last decade has witnessed comparatively less migration to Madras City. In absolute numbers, there were less than a lakh net migrants in 1951-61 to Madras City as against over five lakhs in the earlier decade. The rate of net migration has been only 58 per thousand as against over 552 in the earlier decade. The reason for the fall in net in-migration to the City is probably the growth of suburban towns like Tambaram, Pallavaram, Ambattur, Alandur and Tiruvottiyur. It is difficult to analyse the extent of influence of this process of suburbanisation on the growth of Madras City, and more light will be thrown on this aspect in the report on the metropolitan City of Madras which is being published separately.

Table 13–23

Migration estimates for Madras City based on the Census Survival Ratio Method, 1921-31, 1931-41, 1941-51 & 1951-61

Age Groups at later Census		1921–31		1931–41		1941–51		1951–61	
		Males	Females	Males	Females	Males	Females	Males	Females
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0—4	...	+ 6,094	+ 6,218	+ 5,771	+ 5,759	+13,300	+12,700	+ 6,700	+ 6,389
5—9	...	+ 5,084	+ 5,122	+ 1,996	+ 1,811	+14,300	+12,900	+ 2,171	+ 1,955
10—14	...	+11,916	+11,459	+12,375	+16,533	+38,600	+36,600	+30,980	+31,221
15—19	...	+12,717	+12,402	+11,387	+16,738	+44,500	+33,900	+12,037	+21,511
20—24	...	+16,458	+15,706	+16,569	+14,224	+39,400	+23,300	+18,620	+ 8,617
25—29	...	+11,010	+ 5,722	+10,940	+ 3,432	+34,400	+20,500	+ 8,863	+16,507
30—34	...	+ 3,078	— 1,469	+ 145	— 4,695	+23,900	+19,000	— 1,999	— 1,221
35—39	...	+ 2,705	— 358	+ 1,575	— 2,247	+15,500	+17,800	— 3,647	— 3,826
40—44	...	+ 1,191	— 905	— 1,820	— 2,103	+12,800	+17,000	— 2,888	— 7,522
45—49	...	+ 1,975	+ 2,811	— 3,881	— 994	+10,400	+15,000	+ 3,178	— 3,047
50—54	...	— 1,982	— 1,936	— 4,220	— 2,152	+ 8,700	+13,600	— 2,997	— 5,271
55—59	...	+ 1,082	+ 1,581	— 2,395	— 1,755	+ 7,500	+12,400	— 2,829	— 5,245
60—64	...	— 1,381	— 2,309	— 2,222	— 2,303			— 2,484	— 4,850
65—69	...	+ 30	+ 150	— 3,462	— 3,100	+ 16,200	+25,700	— 3,595	— 5,967
70+	...	+ 106	— 60	— 1,990	— 2,037			— 4,062	— 7,359
All Ages	...	+70,083	+54,134	+40,768	+37,111	+279,500	+260,400	+58,048	+41,892

Table 13–24

Net Intercensal Migration rate for Madras City per 1,000 of Initial Population, 1921-31, 1931-41, 1941-51 & 1951-61

Age Group at later Census		1921–31		1931–41		1941–51		1951–61	
		Males	Females	Males	Females	Males	Females	Males	Females
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
10—14	...	+400	+377	+291	+390	+608	+610	+467	+494
15—19	...	+402	+389	+283	+434	+722	+599	+169	+336
20—24	...	+533	+581	+432	+389	+668	+447	+203	+ 98
25—29	...	+396	+202	+286	+ 89	+607	+423	+107	+247
30—34	...	+ 98	— 47	+ 3	—115	+479	+450	— 27	— 19
35—39	...	+ 83	— 12	+ 40	— 61	+376	+503	— 49	— 62
40—44	...	+ 39	— 34	— 50	— 72	+376	+573	— 44	—130
45—49	...	+ 86	+174	—124	— 43	+380	+611	+ 70	— 74
50—54	...	— 88	—100	—172	—119	+415	+683	— 64	—120
55—59	...	+ 77	+155	—131	—127	+489	+792	— 89	—175
60—64	...	— 96	—178	—176	—221			— 80	—152
65—69	...	+ 4	+ 31	—371	—395	+629	+905	—194	—287
70+	...	+ 7	— 5	—148	—184			—116	—166
All Ages	...	+190	+152	+ 85	+ 85	+546	+559	+ 67	+ 49

CHAPTER XIV

PAST POPULATION TRENDS

No study on demography of Madras State can be complete without an analysis of the past trends in the population growth. The aspects of population growth and change to which the discussion in this chapter will be devoted may involve the following three questions:

(1) What changes have taken place in the size of population of the State and how are the changes in size affected?

(2) Where are people found, and what changes in their distribution in communities and areas are taking place?

(3) What are the characteristics of the population of different areas and how have they changed?

A little elucidation of these three questions will be relevant. In the first place, the mere change in numbers in a community creates new and different social situations which demand serious considerations. For instance, the rapid growth of a large urban community creates an increased need for schools, play-grounds for children, recreation facilities, an improved highway system, etc. In rural areas where population has been growing rapidly, there is need for providing educational and medical facilities and livelihood for the new entrants to the working force.

A second aspect of population change which has attracted considerable attention in recent years is that of distribution of population. The changes in distribution of population chiefly arise as a consequence of the changes in the relative importance of the economic activities of different areas. Changes in distribution of population take place in two ways: (1) the population of one area may have a large excess of births over deaths than that of another area and as a consequence may grow faster, and (2) people may move from one area to another thus leading to a higher rate of growth in the area of in-migration and depressing the rate of growth of the area of out-migration. Vastly varying densities of population in different areas, together with enormous variations in per capita resources, are raising many questions regarding the effect of the distribution of population on the level of living.

The third aspect of our study is that of the changing composition of the population. The chief demographic characteristics of interest to us are age and sex, but there are many social and economic characteristics which are just as important. The more important social and economic characteristics to be treated are marital status, educational status, occupational status, economic status, residential pattern in rural and urban areas and language.

These three aspects are not distinct even if they are treated separately. The growth of population in any given area cannot be understood without giving consideration to the changes in the distribution of population and also of the composition of the population of a given area. The manner of growth—natural increase or migration—will determine to a large extent many of the characteristics of population which in turn have its effect on the growth and distribution of population.

Madras State vis-a-vis rest of India

A synoptic view of the trends in the growth of population of Madras and India is given by the following table:

TABLE 14-1

Absolute and relative growth of population of India and Madras 1901-61

Year	India		Madras	
	Population	Index	Population	Index
(1)	(2)	(3)	(4)	(5)
1901 ...	238,396,327	100.0	19,252,630	1.000
1911 ...	252,093,390	105.7	20,902,616	108.6
1921 ...	251,321,213	105.4	21,628,518	112.3
1931 ...	278,977,238	117.0	23,472,099	121.9
1941 ...	318,660,580	133.7	26,267,507	136.4
1951 ...	361,088,090	151.5	30,119,047	156.4
1961 ...	439,234,771	184.2	33,686,953	175.0

These figures indicate that the population of Madras State has grown faster than that of India as a whole upto 1951, but in the 1951-1961 decade the position seems to have changed. Over the 60 years 1901-1961, the population of Madras State has grown by 75% whereas that of India has increased by 84%. For a clearer picture of the population trends, the growth of population in different States may be examined.

We have presented in Table 14-2 the percentage decade variation of population of Madras State for the

last six decades along with those of other States and this gives a comparative picture of the growth trends of the past. For most States, 1921 appears to be a dividing period in the rate of growth of population, those preceding this year having a low growth compared to the high growth in the subsequent period. Shri R. A. Gopalaswami in his Report for 1951 has described this period as the Great Divide, since according to him this period witnessed a stabilisation and even a decline of mortality, with a consequent increase in the growth rate. In 1901–1911 and 1911–1921, Madras has a higher percentage variation of population than India and this was mostly due to the lower mortality rate prevalent in the State when compared to the rest of India. This is very striking in the 1911-1921 decade which witnessed the great Influenza epidemic which according to Kingsley Davis took 16 million lives in the whole of India. During the same period Madras State lost about a million persons. In the 1921-1931 and 1931-1941 decades, Madras State experienced a percentage growth less than that of India. This was probably due to the heavy out-migration to other States as shown in an earlier chapter. In 1941-1951 the position has changed slightly and Madras State has a higher percentage growth of population when compared to that of India. This is again due to the role of the migration factor which had become inward during this decade as against an outward migration in the earlier decades. In 1951-1961, we again find a reversal of the migration trend to one of outward migration leading to a lower growth rate for the State when compared to that of India.

TABLE 14–2

Percentage decade variation in population during sixty years, India and States

State	1901–11	1911–21	1921–31	1931–41	1941–51	1951–61
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Andhra Pradesh	+12.49	— 0.13	+12.99	+12.75	+14.02	+15.65
Assam	+16.73	+19.01	+19.54	+20.08	+19.28	+34.45
Bihar	+ 3.67	— 0.66	+11.45	+12.20	+10.27	+19.77
Gujarat	+ 7.79	+ 3.79	+12.92	+19.25	+18.69	+26.88
Jammu & Kashmir	+ 7.16	+ 5.75	+10.14	+10.36	+10.42	+ 9.44
Kerala	+11.75	+ 9.16	+21.85	+16.04	+22.82	+24.76
Madhya Pradesh	+15.30	— 1.38	+11.39	+12.34	+ 8.67	+24.17
Madras	+ 8.57	+ 3.47	+ 8.52	+11.91	+14.66	+11.85
Maharashtra	+10.74	— 2.91	+14.91	+11.99	+19.27	+23.60
Mysore	+ 3.60	— 1.09	+ 9.38	+11.09	+19.36	+21.57
Orissa	+10.44	— 1.94	+11.94	+10.22	+ 6.38	+19.82
Punjab	— 9.96	+ 4.35	+ 9.64	+17.81	+ 0.21	+25.86
Rajasthan	+ 6.70	— 6.29	+14.14	+18.01	+15.20	+26.20
Uttar Pradesh	— 0.97	— 3.08	+ 6.66	+13.57	+11.82	+16.66
West Bengal	+ 6.25	— 2.91	+ 8.14	+22.93	+13.22	+32.80
Union Territories	+ 9.85	+ 5.92	+14.95	+18.99	+27.02	+46.31
All India	+ 5.75	— 0.31	+11.00	+14.22	+13.31	+21.51

Another way of looking at the comparative trends in population growth of different States is to work out the share of the population of each State to that of India at different decennial Censuses and this has been attempted in Table 14–3. Between 1901 and 1921, Madras has increased its share in India's population from 8.08% to 8.61% and this was followed by a decline to 8.41% in 1931 and 8.25% in 1941. In 1951, there was an increase to 8.34% but in 1961, it has fallen to 7.67%. This percentage is even lower than the percentage in 1901, indicating that the share of Madras State has declined heavily.

TABLE 14-3

Share of each State in the All-India Population, 1901-61

State	1901		1911		1921		1931		1941		1951		1961	
	Population	Per-cent-age	Population	Per-cent-age	Population	Per-cent-age	Population	Per-cent-age	Population	Per-cent-age	Population	Per-cent-age	Population	Per-cent-age
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Andhra Pradesh	19,065,921	8.00	21,447,412	8.51	21,420,448	8.52	24,203,573	8.68	27,289,340	8.56	31,115,259	8.62	35,983,447	8.19
Assam ...	3,712,638	1.56	4,333,826	1.72	5,157,789	2.05	6,165,612	2.21	7,403,396	2.32	8,830,732	2.45	11,872,772	2.70
Bihar ...	27,314,210	11.46	28,316,916	11.23	28,129,208	11.19	31,349,892	11.24	35,174,146	11.04	38,786,184	10.74	46,455,610	10.58
Gujarat ...	9,094,748	3.81	9,803,587	3.89	10,174,989	4.05	11,489,828	4.12	13,701,551	4.30	16,262,657	4.50	20,633,350	4.70
Jammu & Kashmir ...	2,139,362	0.90	2,292,535	0.91	2,424,359	0.97	2,670,208	0.96	2,946,728	0.93	3,253,852	0.90	3,560,976	0.81
Kerala ...	6,396,262	2.68	7,147,673	2.84	7,802,127	3.10	9,507,050	3.41	11,031,541	3.46	13,549,118	3.75	16,903,715	3.85
Madhya Pradesh ...	16,860,768	7.07	19,440,965	7.71	19,171,750	7.63	21,355,657	7.65	23,990,608	7.53	26,071,637	7.22	32,372,408	7.37
Madras ...	19,252,630	8.08	20,902,616	8.29	21,628,518	8.61	23,472,099	8.41	26,267,507	8.25	30,119,047	8.34	33,686,953	7.67
Maharashtra	19,391,643	8.13	21,474,523	8.52	20,849,666	8.30	23,959,300	8.59	26,832,758	8.42	32,002,564	8.86	39,553,718	9.01
Mysore ...	13,054,754	5.48	13,525,251	5.36	13,377,599	5.32	14,632,992	5.24	16,255,368	5.10	19,401,956	5.37	23,586,772	5.37
Orissa ...	10,302,917	4.32	11,378,875	4.51	11,158,586	4.44	12,491,056	4.48	13,767,988	4.32	14,645,946	4.06	17,548,846	3.99
Punjab ...	13,265,860	5.56	11,945,019	4.74	12,465,009	4.96	13,666,876	4.90	16,101,189	5.05	16,134,890	4.47	20,306,812	4.62
Rajasthan ...	10,294,090	4.32	10,983,509	4.36	10,292,648	4.10	11,747,974	4.21	13,863,859	4.35	15,970,774	4.42	20,155,602	4.59
Uttar Pradesh.	48,625,310	20.40	48,152,273	19.10	46,669,865	18.57	49,776,754	17.84	56,531,848	17.74	63,215,742	17.51	73,746,401	16.79
West Bengal ...	16,940,088	7.11	17,998,769	7.14	17,474,348	6.95	18,897,036	6.77	23,229,552	7.29	26,299,980	7.29	34,926,279	7.95
Union Territories ...	2,685,126	1.12	2,949,641	1.17	3,124,304	1.24	3,591,331	1.29	4,273,201	1.34	5,427,752	1.50	7,941,110	1.81
All India ...	238,396,327	100.00	252,093,390	100.00	251,321,213	100.00	278,977,238	100.00	318,660,580	100.00	361,088,090	100.00	439,234,771	100.00

Considering the period 1901–1961 as a whole we find that apart from Madras, the declining States are Andhra Pradesh, Bihar, Jammu and Kashmir, Mysore, Orissa, Punjab and Uttar Pradesh. Of these, Uttar Pradesh and Bihar have shown a more or less steady downward trend. If we consider only the last decade we find Andhra Pradesh, Bihar, Jammu and Kashmir, Madras, Orissa and Uttar Pradesh are the only declining States. Among the southern States, Mysore has remained stationary and Kerala has gained. As shown in earlier chapters, traditionally, Madras has been an out-migrating State and the quantum of out-migration has been of a high order during the last decade. From the place of birth statistics of 1961 Census, the States that have received a heavy influx of migrants from Madras are found to be Mysore, Kerala, Andhra and Maharashtra.

Age structure

As pointed out earlier, the age composition of population is the most basic demographic characteristic and it is instructive to examine the trends in the age composition. Table 14–4 gives the trends in the percentage distribution of population over the period 1901 to 1961. We find that the percentage in the age group 0–14 has declined from 39.7 in 1901 to 37.6 in 1961. The trend has not been uniform throughout. There was a decline in the percentage upto 1921 followed by a slight increase in 1931 and 1941. In 1951, there was again a decline and the year 1961 witnessed a slight increase in the percentage. Similar trends are noticed for either sex. In the working age groups 15 to 59, we find a percentage of 54.7% in 1901. This is followed by a more or less steady proportion (around 56%) from 1911 to 1941. In 1951 there has been an increase to 58.2% and in 1961 it has again fallen to 56.8%. The old age group 60+ has remained more or less same throughout (around 5.6%) except during 1931 and 1941 when it was around 4.5%.

TABLE 14–4

Percentage distribution of Madras Population by broad age groups

Year	Males			Females			Total		
	0—14	15—59	60+	0—14	15—59	60+	0—14	15—59	60+
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1901	40.5	54.1	5.4	39.0	55.2	5.8	39.7	54.7	5.6
1911	38.5	55.8	5.7	37.2	56.8	6.0	37.8	56.3	5.9
1921	37.8	56.3	5.9	37.0	57.1	5.9	37.4	56.7	5.9
1931	39.3	56.0	4.7	38.2	57.3	4.5	38.8	56.7	4.5
1941	39.1	56.4	4.5	38.4	57.0	4.6	38.7	56.7	4.6
1951	36.2	58.3	5.5	36.2	58.1	5.7	36.2	58.2	5.6
1961	37.7	56.7	5.6	37.5	56.9	5.6	37.6	56.8	5.6

It is usual to classify populations as "young" if they have less than 4% of persons above 65 years, as "mature" when this percentage is between 4 and 7, and as "aged" when it exceeds 7%. It appears that an overwhelming proportion of world population may be regarded as "young or mature," and only a very small proportion as "aged." Furthermore, the "aged" countries would comprise only a small proportion of the world's populace and would cover only a small part of the globe's surface. Madras has a fairly "young" population whereas those of the economically advanced countries of Western Europe, U.S.A., Canada and Oceania have the most "aged" populations.

In the middle of the nineteenth century the populations of Great Britain, France and Sweden were characterised by very regularly shaped age pyramids resting on a wide base. In France, however,

the base was narrower, indicating that France was experiencing, the ageing process earlier than the other two populations. During the second half of the last century, comparatively little change occurred, though the percentage of children did decline slightly in all the three countries and in Sweden the apex of the pyramid broadened. By 1950, the shape of the pyramid had changed completely, so that each of them resembled a barrel resting on a base rather than a pyramid. But the base widened after the war due to an increase in the birth rate after the World War. The bulge in the middle age level is characteristic of an aging population. It is reflected in the increased proportion of adults, as also to an increase in the proportion of the old. Table 14–5 gives the actual proportion of old people in relation to the total population in each country at various dates as well as the indices with about 1900 as base. We notice that the populations of Western Europe included about 5% of old people towards the middle of the last century, a substantially higher proportion than that obtaining to-day among many populations of the world.

TABLE 14–5

Percentage of persons aged 65 and over to total population in selected countries, 1900-1950

Country	Aggregates in or about						Indices (1900=100)					
	1900	1910	1920	1930	1940	1950	1900	1910	1920	1930	1940	1950
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Africa												
Egypt ...	N.A.	N.A.	N.A.	2.90	3.64	3.10	...	...	...	...	...	...
North America												
Canada ...	5.07	4.66	4.78	5.56	6.67	7.76	100	92	94	110	132	153
U.S.A. ...	4.07	4.30	4.67	5.41	6.85	8.14	100	106	115	133	168	200
South America												
Argentina ...	1.95	2.31	N.A.	N.A.	N.A.	3.94	100	118	...	...	...	202
Brazil ...	2.11	N.A.	N.A.	N.A.	2.40	2.46	100	...	...	...	114	117
Chile ...	N.A.	N.A.	3.30	3.41	3.50	N.A.	...	...	...	...	...	...
Asia												
Ceylon ...	N.A.	2.30	2.39	N.A.	N.A.	3.45	...	...	...	...	...	...
India ...	N.A.	2.39	2.49	2.17	N.A.	3.59	...	...	...	...	...	...
Japan ...	N.A.	N.A.	5.26	4.75	4.71	4.94	...	...	...	...	...	...
Europe												
Austria ...	4.98	5.27	6.23	6.77	8.81	10.57	100	106	125	136	177	212
Belgium ...	6.18	6.37	6.49	7.59	N.A.	10.69	100	103	105	123	...	173

TABLE 14-5—(*Contd.*)

Percentage of persons aged 65 and over to total population in selected countries, 1900-1950—(*Contd.*)

Country	Aggregates in or about						Indices (1900=100)					
	1900	1910	1920	1930	1940	1950	1900	1910	1920	1930	1940	1950
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Europe—(Contd.)												
Bulgaria ...	5.13	5.34	5.66	5.21	N.A.	N.A.	100	104	110	102	...	...
Denmark ...	6.66	6.62	6.85	N.A.	7.52	8.38	100	99	103	...	113	126
France ...	8.20	8.36	9.05	9.35	N.A.	11.80	100	102	110	114	...	144
Germany ...	4.88	5.04	5.77	7.36	8.86	9.27	100	103	118	151	182	190
Greece ...	N.A.	4.13	5.66	5.86	6.31	N.A.	...	...	...	...	...	...
Great Britain ...	4.69	5.22	6.03	7.40	8.97	10.83	100	111	129	158	191	231
Italy ...	6.16	6.50	6.75	N.A.	7.43	N.A.	100	106	110	...	121	...
Netherlands ...	6.01	6.12	5.88	6.21	7.01	7.73	100	102	98	103	117	129
Norway ...	7.91	7.79	7.70	8.29	N.A.	9.62	100	98	97	105	...	122
Portugal ...	5.72	5.90	5.92	6.19	6.46	6.97	100	103	103	108	113	122
Spain ...	N.A.	N.A.	N.A.	N.A.	6.53	7.23	...	...	...	...	...	...
Sweden ...	8.37	8.44	8.40	9.20	9.41	10.31	100	101	100	110	112	123
Switzerland ...	5.84	5.80	5.83	6.87	8.56	9.62	100	99	100	118	147	165
Oceania												
Australia ...	N.A.	4.29	4.42	6.49	N.A.	8.04	...	...	...	...	...	...
New Zealand ...	4.06	4.73	4.89	6.56	9.02	9.57	100	116	120	162	222	236

N.A. denotes not available. *Source :* The Aging of Population and its Economic and Social Implications, U.N., 1956.

Usually, increases in the proportion of old is accompanied by or preceded by an increase in the proportion of adults (*viz.*, those in the age group 15 to 64). On the whole, the aged populations have a considerably larger proportion of persons aged 15 to 64 than do the relatively younger populations. In the former, this

percentage varies between 65 and 70, whereas in the latter, it rarely exceeds 55. Table 14–6 gives a picture of the trends in this proportion in the past and this indicates little change in the second half of the last century, *i.e.*, in the period during which the proportion of the old, too, changed very little. A considerable rise in the proportion of adults took place in 1900 to 1940 period, when it increased for instance from about 63 to 70% in Great Britain, from 59 to 70% in Sweden and from 61 to 68% in U.S.A. The sharp rise in the birth rate at the end of the war led to a slight decline in the proportion of adults in 1940 to 1950.

TABLE 14–6

Percentage of persons aged 15—64 to total population in selected countries, 1900—1950

Country	Aggregates in or about						Indices (1900=100)					
	1900	1910	1920	1930	1940	1950	1900	1910	1920	1930	1940	1950
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Africa												
Egypt	N.A.	N.A.	N.A.	58.41	57.17	58.81	...	...	...	...	...	...
North America												
Canada	60.38	62.27	60.78	62.81	65.53	61.90	100	103	101	104	109	103
U.S.A.	61.46	63.57	63.49	65.20	68.11	64.99	100	103	103	106	111	106
South America												
Argentina	57.70	59.26	N.A.	N.A.	N.A.	65.21	100	103	...	...	...	113
Brazil	52.86	N.A.	N.A.	N.A.	55.06	55.69	100	...	...	...	104	105
Chile	N.A.	N.A.	57.67	58.69	59.25	N.A.	...	...	...	...	...	...
Asia												
Ceylon	N.A.	56.81	58.24	N.A.	N.A.	59.32	...	...	...	...	...	...
India	N.A.	59.16	58.46	57.81	N.A.	58.96	...	...	...	...	...	...
Japan	N.A.	N.A.	58.27	58.69	59.24	59.63	...	...	...	...	...	...
Europe												
Austria	60.62	59.89	68.39	70.59	70.05	66.53	100	99	113	116	116	110
Belgium	62.09	63.07	68.49	69.44	N.A.	68.73	100	102	110	112	...	111
Bulgaria	54.67	55.28	58.09	59.26	N.A.	N.A.	100	101	106	108	...	...
Denmark	59.41	59.73	61.96	N.A.	67.06	66.97	100	101	104	...	113	113
France	65.68	65.88	68.22	67.72	N.A.	66.53	100	100	104	103	...	101

TABLE 14-6—(*Contd.*)

Percentage of persons aged 15—64 to total population in selected countries, 1900–1950—(*Contd.*)

Country	Aggregates in or about						Indices (1900=100)					
	1900	1910	1920	1930	1940	1950	1900	1910	1920	1930	1940	1950
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Europe—(Contd.)												
Germany ...	60.33	60.92	68.20	69.11	66.46	67.13	100	101	113	115	110	111
Greece ...	N.A.	57.58	60.08	61.97	60.70	N.A.	...	...	...	...	...	...
Great Britain ...	62.76	63.94	66.03	68.43	69.64	66.67	100	102	105	109	111	106
Italy ...	59.72	59.55	62.06	...	61.94	...	100	100	104	...	104	...
Netherlands ...	N.A.	N.A.	61.51	63.17	65.14	62.99	...	...	...	...	...	...
Norway ...	56.54	56.85	60.21	63.21	...	65.98	100	101	106	112	...	117
Portugal ...	60.49	59.69	61.31	61.83	61.47	63.55	100	99	101	102	102	105
Spain ...	N.A.	N.A.	N.A.	N.A.	63.53	66.54	...	...	...	...	...	...
Sweden ...	59.19	59.84	62.31	65.95	70.19	66.28	100	101	105	111	119	112
Switzerland ...	63.18	62.96	66.22	68.55	69.32	66.84	100	100	105	108	110	106
Oceania												
Australia ...	N.A.	63.95	63.76	66.03	N.A.	66.74	...	...	...	...	...	...
New Zealand ...	62.54	63.95	63.71	67.92	65.21	62.05	100	102	102	109	104	99

N.A. denotes not available.

Source : The Aging of Population and its Economic and Social Implications, U.N., 1956, Page 15.

As a result of high mortality and high fertility, India has an extremely young population. This observation is true of Madras State also which has an age pyramid with a broad base and a quickly attenuated top. It is strikingly different from those countries of low fertility and low mortality. Unlike in the demographically developed countries, most of the dependents here are children whereas in U.S.A. and U.K. there is the problem of preponderance of old people. Even though the 'childhood dependency' is less expensive than the 'old age dependency,' the latter is bound to take place one day or other and there will be an intermediate stage of minimum dependency at either end.

Analysing the percentage of population in major age groups in selected countries, it is seen that a greater proportion of population of U.S.A. and U.K. are in productive ages than countries like India. The United States has over 55% of its population in these reproductive ages whereas India has only 30%. We have a larger burden of dependency particularly in the young ages. In addition to this we have a larger number of dependents of the working ages mostly due to ill-health associated with a high mortality.

Another important aspect of the age structure is its contribution to future population growth. Kingsley Davis has pointed out that the Indian sub-continent has a greater potential growth in the next few decades than the United States. His argument is that "in America the diminutive groups at the bottom of the pyramid will eventually occupy the middle position and the present bulge in the middle will move to the top, at which time the crude birth rate and rate of population growth will both decline, given the same intrinsic fertility. In India, on the other hand, if mortality continues to decline, the growth of population will be enormous. Huge numbers now in the lower age brackets will grow into adults, giving birth in turn to still larger cohorts. In the past a high mortality has flattened the sides of the age pyramid; a lessened mortality will make them more perpendicular".

With this general background we may examine the situation in Madras State. The specific question which is of interest to demographers is whether the Madras population is 'aging.' A population is said to 'age at the apex' when the proportion of aged persons increases. If on the contrary, the proportion of young persons increases, the population is supposed to 'age at the base.' In order to examine whether there has been any aging at the apex or at the base, the percentages of population aged 65 and over, 0 to 15 and 15 to 64 have been computed and presented in Table 14–7.

TABLE 14–7

Evidences regarding changes in age structure

Year	Percentage of Population 65+		Index (1921=100)	
	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)
(a) Percentage of population aged 65 and above in Madras Censuses				
1921 ...	3.31	3.32	100	100
1931 ...	2.67	2.60	81	78
1941 ...	2.63	2.72	79	82
1951 ...	3.01	3.14	91	95
1961 ...	3.16	3.23	95	97
(b) Percentage of young population (upto 15 years of age) in Madras Censuses				
1921 ...	39.33	38.25	100	100
1931 ...	40.50	39.03	103	102
1941 ...	40.71	39.73	104	104
1951 ...	37.30	36.69	95	96
1961 ...	38.87	37.84	99	99
(c) Percentage of population in the working ages 15–64 in the Madras Censuses				
1921 ...	57.36	58.43	100	100
1931 ...	56.83	58.37	99	100
1941 ...	56.66	57.55	99	99
1951 ...	59.69	60.17	104	103
1961 ...	57.97	58.93	101	100

It is seen that when compared to 1921, the percentage of persons over 65 has been less in 1961, the index being 95 for males and 97 for females if 1921 is taken as 100. There has not been a steady process. There appears to have been a reversal some time in 1921 to 1931 with a fall in the proportions in 1931 followed by a more or less steady rise in the proportions. If 1931 is taken as the base instead of 1921, this will indicate an 'aging at the apex.'

Now let us examine the proportions of children upto 15 years to the total population. Here, no steady trend is discernible except that after an upward and downward movement, the proportion of children in 1961 stands at the same level as the 1921 level. The same pattern is found in the age group 15–64 where again the proportion in 1961 remains more or less at its 1921 level.

It appears that by and large there has been little change in the age structure of Madras population except that there has been some 'aging at the apex' since 1931. The result seems to be more or less in conformity with world experience which reveals little change in the age structure. This is true particularly of under-developed countries, or rather, of all countries with a high fertility. Only in the economically advanced countries has the age structure been changed over the years, by aging from the base and at the apex, a phenomenon whose appearance has more or less coincided with the decline of fertility observed in those countries. The stability of age structure in countries with high fertility suggests that fertility movements have played a fundamental part in the development of this aging. Changes in mortality appear to have played only a secondary part.[1]

No clear explanations are available regarding the steep fall in the proportion aged 65 and over in 1931 followed by a steady rise in this proportion since then. The reduction of mortality, as it occurred historically, has had little effect on the age structure of populations. It has led to rejuvenation at the base, *i.e.*, an increase in the proportion of young persons, and has left the apex of the pyramid practically unchanged. A comparison of the percentages in 0–14 age group in 1921 and 1931 shows that a rejuvenation at the base has taken place in this period as an aftermath of the influenza epidemic in the 1911–21 period. The only plausible explanation to the steep fall in the proportion of aged persons between 1921 and 1931 is that the toll of influenza epidemic should have been particularly heavy among persons aged 50 and over. This age group in

[1] United Nations: The Aging of Populations and its Economic and social implications, p. 1.

particular has a limited resistance against diseases and epidemics.

The developments since 1931 can be explained only in terms of a fall in fertility which historically leads to an aging both at the apex and at the base. The following figures testify this.

TABLE 14-8

Indices of aging population, 1931, 1941 and 1951

Year		Index for 65+		Index for 0—14	
		Males	Females	Males	Females
(1)		(2)	(3)	(4)	(5)
1931	...	81	78	103	102
1941	...	79	82	104	104
1951	...	91	95	95	96

It is evident that there has been some aging both at the apex and at the base since 1931. The year 1961 stands apart from this picture because the figure for 1961 reveals a rejuvenation at the base and an aging at the apex. Such a situation is attributable only to a reduction in mortality without any change in fertility. The following conclusions emerge from the foregoing discussions.

(1) Between 1921 and 1931 there was a reduction in mortality without any change in fertility. This has led to a rejuvenation both at the base and at the apex.

(2) Between 1931 and 1951, there has been a reduction in fertility with little change in mortality. This has led to an aging of population both at the base and at the apex.

(3) The year 1961 stands apart from the earlier picture in the sense that there has been a further aging at the apex with a slight rejuvenation at the base. This can be attributed mainly to a reduction in mortality with little change in fertility.

Although the reduction of mortality has hitherto led to rejuvenation from the base, aging both from the base and at the apex can now be expected. For the time being, due to the advances in medical science and economic and social development, Madras State and in fact many developing areas of the world are experiencing a reduction of mortality without any decline in fertility. There is thus a rejuvenation from the base, the apex of the pyramid remaining unchanged. It is reasonable to suppose, however that mortality will not continue to decline indefinitely without leading to a decline in fertility, which will lead to heavy aging from the base and at the apex. It can therefore be forecast that Madras will sooner or later experience a process similar to the one taking place in Japan, *viz.*, a phase of rejuvenation will be followed by a phase of heavy aging.

Implications of changes in age structure

The changes in age structure has far-reaching implications from the social and economic points of view. It is a matter of common knowledge that the economic activity of individuals varies with their age. In a population of a given age structure, the economic activity of individuals determines the labour supply of the population concerned and likewise on the community's output and consumption. Without going into the implications of changes in age structure on economic activity, production and consumption functions, certain broad conclusion can be drawn regarding the effect of such changes on the burden of dependency, likely levels of fertility, etc.

The following indices have been worked out for analysing the effect of changes in age structure.

(1) Dependency ratios of young and old which express the persons in 0-14 and 65+ as a percentage of those in the working ages, *viz.*, 15-64.

(2) Child-Woman ratios which express children in ages 0—4 as a ratio of women in ages 15—44 and children in ages 5—9 as a ratio of women in ages 20—49.

(3) Percentage of women in the reproductive ages, *viz.*, 15—44 to all women.

The values of these indices for each of the Census years 1921 to 1961 are presented in Table 14-9.

It is noticed from this table that the burden of dependency has been more or less at its 1921 level. In 1961, for every 100 persons in the working ages, 65.6 children and 5.5 persons aged 65 and over are found, which shows that the dependency burden in Madras is rather heavy when compared to countries like Great Britain and U.S.A. where there are about 40 children and 15 old persons for every 100 persons in the working ages.

TABLE 14–9

Some Indices of Demographic effects of changes in age structure of Madras Population

Census Year	Dependency Ratios			Child Woman Ratios		
	$\frac{0-14}{15-64} \times 100$	$\frac{65 \text{ \& above}}{15-64} \times 100$	$\frac{(0\text{-}14)+65 \text{ \& above}}{15-64} \times 100$	$\frac{C_{0-4}}{W_{15-44}} \times 1{,}000$	$\frac{C_{5-9}}{W_{20-49}} \times 1{,}000$	Percentage of women in 15—44
1921 ...	67.0	5.7	72.7	667	622	45.11
1931 ...	69.0	4.6	73.6	704	600	46.46
1941 ...	70.4	4.7	75.1	696	653	45.45
1951 ...	61.7	5.1	66.8	622	567	45.72
1961 ...	65.6	5.5	71.1	676	619	45.46

The child woman ratios do not reveal any clear trends and no definite conclusions can be drawn from the ups and downs in these ratios. The child woman ratio is affected by several factors such as infant mortality, mortality of women in reproductive ages, changes in fertility and changes in marital customs, etc. It is such a mixture of all these factors that for drawing any valid inferences regarding what they indicate, the analysis cannot be confined to these ratios alone. In fact, one should go into the entire social factors contributing to them and this is rather a gigantic task beyond the scope of this report.

The percentage of women in reproductive ages has been computed and presented here to indicate how changes in age structure can affect fertility. If this percentage increases, the conjugal habits remaining the same, one should expect a rise in fertility and *vice versa.* It is noticed from Table 14–9 that the percentage of reproductive women in Madras population has been more or less stationary throughout the last half a century and hence one cannot expect any change in fertility now. However, it is believed that conjugal habits have not remained unchanged during the last half a century and there has been a considerable amount of postponement of marriages which could have led to a fall in fertility. This is a matter for further examination in the light of evidences regarding proportions of married women, infant mortality rate, etc.

One of the most fundamental ratios in demographic analysis is the sex ratio which expresses males in terms of 100 females or *vice versa.* For the purpose of the present study, the sex ratios (males per 1,000 females) have been computed and presented in Table 14–10. There are ups and downs in the sex ratios which cannot be adequately explained by past demographic events, nor can we be very definite whether such variations are due to residual errors in the age data after smoothing. Broadly, we find

(*a*) an excess of males over females in 0–4, 10–14, 15–19 and between 35 and 64. The exceptions to this are 15–19 in 1931 and 1961, 35–39 in 1941, 50–54 in 1921 and 60–64 in 1951.

(*b*) an excess of females over males in 5–9, 20 to 34, 65 and above, the exceptions being 5–9 and 65–69 in 1931 and 65–69 in 1961.

TABLE 14–10

Sex Ratios for Madras State by five year age groups from Graduated Data

Age Group		Sex Ratio (Males per 1,000 Females)				
		1921	1931	1941	1951	1961
0— 4	...	1,017	1,034	1,049	1,058	1,104
5— 9	...	966	1,010	982	983	1,006
10—14	...	1,038	1,013	1,025	1,005	1,026
15—19	...	1,003	945	1,001	1,008	998
20—24	...	888	875	929	963	938
25—29	...	875	886	908	941	926
30—34	...	943	949	946	971	973
35—39	...	1,007	1,015	996	1,019	1,041
40—44	...	1,003	1,045	1,027	1,035	1,086
45—49	...	990	1,033	1,042	1,021	1,088
50—54	...	998	1,014	1,053	1,016	1,072
55—59	...	1,012	1,005	1,046	1,015	1,064
60—64	...	1,012	1,016	1,021	991	1,043
65—69	...	996	1,025	986	972	1,022
70+	...	945	993	936	943	977

Adequate explanations are not available regarding causes for such variations in sex ratios; but it appears that sex selective migration can be one plausible reason for such sex ratios. The erratic nature of age reporting in Censuses and the inadequacy of the existing techniques of smoothing the age data can also contribute to such tendencies. Apart from focussing attention on this aspect, we are unable to draw any definite conclusions on this subject.

Past trends in Natural increase

We have treated birth and death rates separately in the earlier chapters and we may now consider them together to assess their impact on the growth of population.

There appears to be a steady decline in the birth rate throughout the period, but the death rate has fluctuated widely prior to 1921, but since 1921, there appears to be a more or less steady decline in the death rate as well. As pointed out in earlier chapters the decline in the death rate can be attributed to the growth of health services in the State and the progress in the elimination of epidemic and endemic diseases. On the other hand, no definite reason can be attributed to the significant decline in the birth rate that has occurred in the past. As early as 1931, Mr. Yeatts has mentioned the prevalence of indigenous methods of contraception among certain communities and in 1951 Mr. Venkateswaran has indicated that the difficult economic conditions of the masses may be responsible for a decline in the birth rate. Whatever be the reasons for the changes in birth rate, the natural increase rate has been subject to considerable fluctuations.

For the purpose of understanding population growth, it is not enough to know the crude rate of natural increase. It is also necessary to know the migration rate. The estimates of migration rates presented in the chapters on migration are those obtained by the Survival Ratio Method and in fact the estimated death rates are obtained after deducting the migration rates from the rates of natural increase. It is difficult to fix the levels of birth, death as well as migration rates and the figures presented here should be taken only as a close approximation to the actual rates. It is however clear that migration has played a large part in the demographic history of Madras State. In the past, Madras has mostly contributed to an out-migration and only the 1941–1951 decade was an exception to this trend. This decade actually witnessed an influx of population, mostly of Madras origin who had settled earlier in Burma, Malaya and Ceylon. This return migration was the result of the Second World War and the post-war spirit of nationalism which made conditions of life of aliens difficult. In 1951–1961 there appears to be again a reversal to the traditional pattern of out-migration, but now the flow of out-migration being towards the adjoining States.

Changing demographic characteristics of Madras population

Mere numbers do not signify anything except to indicate the presence or absence of factors favourable to an increase in population. They only tell that birth rate or death rate has changed and this does not tell anything more about the underlying social phenomena. A more useful picture can be had by an examination of the changing characteristics of the population—its young and old age groups, those who are in the school-going age and those in the reproductive and working ages. This has been attempted in Table 14–11, where both the absolute and relative numbers in each category are presented over the period 1901 to 1961. Among the categories considered, the population of working ages has recorded the highest increase (82%) whereas the primary school age population has increased only by 59%. There is an increase of 71% in the population of children aged 5 and below and in the reproductive and working ages there is an increase of 74%.

TABLE 14–11

Some Demographic Indices for Madras, 1901-61

Details	1901	1911	1921	1931	1941	1951	1961
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
A. Population							
1. Children below 5 ...	2,695,276	2,894,910	2,746,401	3,411,566	3,561,751	3,647,614	4,609,769
2. Children in Primary School age, 5—9 ...	2,716,616	2,695,114	2,886,584	2,991,000	3,569,505	3,582,710	4,307,284
3. Children in Higher Elementary School age, 10—14 ...	2,236,840	2,317,566	2,454,259	2,696,447	3,040,046	3,668,871	3,750,118
4. Females in the reproductive age, 20—49 ...	4,039,783	4,435,247	4,640,806	5,043,853	5,503,397	6,291,012	7,015,271
5. Population in the working age, 15—59 ...	10,521,056	11,771,100	12,263,913	13,305,657	14,899,017	17,541,573	19,130,899
6. Old age population (60+) ...	1,082,842	1,223,926	1,277,361	1,067,429	1,197,188	1,678,279	1,886,446
B. Indices (1901=100)							
1. Children below 5 ...	100	107	102	127	132	135	171
2. Children in Primary School age, 5—9 ...	100	99	106	110	131	132	159
3. Children in Higher Elementary School age, 10—14 ...	100	104	110	121	136	164	168
4. Females in the reproductive age, 20—49	100	110	115	125	136	156	174
5. Population in the working age, 15—59 ...	100	112	117	126	142	167	182
6. Old age population (60+) ...	100	113	118	99	111	155	174

Distribution of population in different districts

Table 14-12 gives the percentage decade variation of population by districts for the sixty years 1901-1961. Our observations from the table have been summarised below:

Decade	Districts Below State average	Districts Above State average
1901-1911 ...	Madras Chingleput Salem Coimbatore Nilgiris Tiruchirapalli Thanjavur Tirunelveli	North Arcot South Arcot Madurai Ramanathapuram Kanyakumari
1911-1921 ...	Madras South Arcot Salem Thanjavur Ramanathapuram	Chingleput North Arcot Coimbatore Nilgiris Madurai Tiruchirapalli Tirunelveli Kanyakumari
1921-1931 ...	South Arcot Tiruchirapalli Thanjavur Ramanathapuram Tirunelveli	Madras Chingleput North Arcot Salem Coimbatore Nilgiris Madurai Kanyakumari
1931-1941 ...	Chingleput South Arcot Thanjavur Ramanathapuram Tirunelveli	Madras North Arcot Salem Coimbatore Nilgiris Madurai Tiruchirapalli Kanyakumari
1941-1951 ...	Chingleput North Arcot South Arcot Tiruchirapalli Ramanathapuram Tirunelveli	Madras Salem Coimbatore Nilgiris Madurai Thanjavur Kanyakumari
1951-1961 ...	North Arcot South Arcot Madurai Tiruchirapalli Thanjavur Tirunelveli	Madras Chingleput Salem Coimbatore Nilgiris Ramanathapuram Kanyakumari

TABLE 14-12

Percentage decade variation in population during sixty years, Madras State and districts

District		1901-11	1911-21	1921-31	1931-41	1941-51	1951-61
Madras	...	+ 4.07	+ 2.81	+24.01	+20.17	+60.64	+22.11
Chingleput	...	+ 7.09	+ 5.15	+ 9.30	+10.00	+ 8.11	+12.17
North Arcot	...	+12.24	+ 5.05	+13.21	+13.69	+10.95	+ 8.51
South Arcot	...	+12.19	— 1.80	+ 5.79	+ 6.28	+ 6.44	+ 9.77
Salem	...	+ 3.92	+ 3.41	+13.97	+17.93	+17.69	+12.85
Coimbatore	...	+ 7.14	+ 6.31	+11.38	+15.01	+17.21	+12.78
Nilgiris	...	+ 5.08	+ 6.66	+33.84	+23.85	+48.65	+31.30
Madurai	...	+12.81	+ 4.15	+ 9.43	+13.22	+16.89	+11.05
Tiruchirapalli	...	+ 8.42	+ 4.05	— 0.67	+12.11	+13.48	+ 8.36
Thanjavur	...	+ 5.25	— 1.53	+ 2.40	+ 7.44	+16.36	+ 8.82
Ramanathapuram	...	+ 9.17	+ 3.27	+ 7.02	+ 7.62	+ 4.52	+16.33
Tirunelveli	...	+ 8.10	+ 6.42	+ 7.29	+ 9.80	+ 9.52	+ 8.99
Kanyakumari	...	+17.54	+17.02	+17.75	+16.35	+22.07	+20.64
State	...	+ 8.57	+ 3.47	+ 8.52	+11.91	+14.66	+11.85

It appears that Kanyakumari is the only district which has throughout recorded higher rates of growth than the State as a whole. Nilgiris and Coimbatore have occupied this position from 1911-1921 onwards and Madras and Salem since 1921-1931. Except in 1911-1921, in all other decades, Tirunelveli has recorded growth rates below the State average, and South Arcot has had growth rates below the State average except in 1901-1911. A more vivid portrayal of the place of each district is found in Table 14-13.

TABLE 14-13

Share of each district in the Madras State Population, 1901-1961

District	1901 Population	1901 Percentage	1911 Population	1911 Percentage	1921 Population	1921 Percentage	1931 Population	1931 Percentage	1941 Population	1941 Percentage	1951 Population	1951 Percentage	1961 Population	1961 Percentage
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Madras ...	552,899	2.87	575,377	2.75	591,536	2.73	733,552	3.13	881,485	3.36	1,416,056	4.70	1,729,141	5.13
Chingleput ...	1,337,945	6.95	1,432,748	6.85	1,506,515	6.97	1,646,612	7.02	1,811,230	6.90	1,958,090	6.50	2,196,412	6.52
North Arcot ...	1,722,132	8.94	1,932,958	9.25	2,030,642	9.39	2,298,855	9.79	2,613,526	9.95	2,899,592	9.63	3,146,326	9.34
South Arcot ...	2,105,809	10.94	2,362,566	11.30	2,320,085	10.73	2,454,507	10.46	2,608,753	9.93	2,776,767	9.22	3,047,973	9.05
Salem ...	1,982,911	10.30	2,060,724	9.86	2,131,000	9.85	2,428,780	10.35	2,864,246	10.90	3,370,974	11.19	3,804,108	11.29
Coimbatore ...	1,844,404	9.58	1,976,049	9.46	2,100,727	9.71	2,339,807	9.97	2,691,057	10.24	3,154,296	10.47	3,557,471	10.56
Nilgiris ...	112,882	0.59	118,618	0.57	126,519	0.58	169,330	0.72	209,709	0.80	311,729	1.04	409,308	1.22
Madurai ...	1,699,477	8.83	1,917,152	9.17	1,996,737	9.23	2,184,932	9.31	2,473,866	9.42	2,891,817	9.60	3,211,227	9.53
Tiruchirapalli ...	2,065,034	10.72	2,238,856	10.71	2,329,607	10.77	2,313,895	9.86	2,594,089	9.87	2,943,837	9.78	3,190,078	9.47
Thanjavur ...	2,248,090	11.67	2,366,089	11.32	2,329,959	10.77	2,385,964	10.16	2,563,422	9.76	2,982,715	9.90	3,245,927	9.64
Ramanathapuram.	1,533,902	7.97	1,674,629	8.01	1,729,353	8.00	1,850,806	7.88	1,991,816	7.58	2,081,791	6.91	2,421,788	7.19
Tirunelveli ...	1,687,897	8.77	1,824,590	8.73	1,941,713	8.98	2,083,208	8.87	2,287,333	8.71	2,505,003	8.32	2,730,279	8.10
Kanyakumari ...	359,248	1.87	422,260	2.02	494,125	2.29	581,851	2.48	676,975	2.58	826,380	2.74	996,915	2.96
State ...	19,252,630	100.00	20,902,616	100.00	21,628,518	100.00	23,472,099	100.00	26,267,507	100.00	30,119,047	100.00	33,686,953	100.00

CHAPTER XV

POPULATION PROJECTIONS FOR MADRAS STATE, 1961-81

Introduction

Any study of the population of Madras State will not be complete, if it does not give a picture of the future trends in population growth. Such an assessment of future trends is also important in view of the need for such data for formulating plans for economic development. The common demographic questions that arise in planning are: how many people are there in the State, where they are, what are their ages, what proportion is married and what proportion is working? The estimates of future food requirements are related to age and sex structure of the future population. The estimation of future school-age population and the requirements of class room facilities and teachers depends upon the age structure of the population. A knowledge of the size of the labour force and the formulation of programmes for employment has to be related to the age-sex structure of the population and the level of participation in gainful activities. Last but not the least, provision of measures of social security such as old age pensions, health insurance, etc., require sound projections of population for the State.

In this chapter, we have attempted to present a set of population projections for Madras State for the period 1961 to 1981 taking into account all the relevant factors affecting population growth in the State. Our analysis of the factors operating in the State have been examined in detail in the earlier chapters and the question that has to be answered is broadly, how the three factors, fertility, mortality and migration are likely to behave in the future. While any assumption regarding the future levels of these factors is still in the nature of a guess, several demographic studies have shown that the guess can be made as close to reality as possible by taking stock of the past situation. This is again the area of wildest speculation since quite often, the past trends are no guide to the future at all, and a departure from past trends often upsets the most judicious assumption. All this is said by way of caution lest the reader should think that the projection attempted here is a categorical prediction of the population of the future. It can only be said that the population will be as indicated in the projection, if the factors of population growth behave in the manner postulated in the projection. Before setting down the methodology and assumptions involved in our projection it is worthwhile to indicate the earlier projections for Madras State.

Earlier Projections for the State

There are three projections that have been attempted for the State at different periods. These three are (1) Gopalaswamy's Projections, 1956–1981. (2) Expert Committee's Projections, 1956 to 1966. (3) Vaidyanathan's Projections, 1951–1981. These are briefly reviewed below.

(1) *Gopalaswamy's Projections:* Shri R. A. Gopalaswamy attempted a projection of the erstwhile composite Madras State on the basis of the following assumptions. (1) Apart from the disappearance of child marriages, there will be no material change in marital or conjugal habits; married women of the same number and the same age will be giving birth to approximately the same number of children during each of the thirty years 1951–1980 as on an average of the thirty years 1921–50. (2) The mortality rates in every age group will be approximately the same during each of the next thirty years 1951–1980 as on an average of the thirty years 1921–50. The projections are given for males and females according to the broad age groups 0–14, 15–54 and 55 and over.[1] Many facts which were not available at the time when these projections were attempted and which have since become available have confirmed Gopalaswamy's conjecture that a further reduction in mortality may be expected in the future whereas fertility will remain more or less stable unless the practice of contraception becomes widespread.

(2) *Expert Committee's Projections:*[2] The Expert Committee on Vital and Health Statistics has derived the population projections for States for 1956 to 1966 by the Ratio Method. This involved a basic projection for India which was based on the following assumptions. (1) The general fertility rate of 189 consistent with a birth rate of 42 per thousand around 1951 would remain unchanged during 1951–66, (2) Mortality could be taken to be improving so that expectation of life at birth steadily increases from 32 in 1946 to 50 in 1966 *i.e.*, by 0.9 per annum. (3) The fall in the Indian life table

[1] Census of India, 1951, Part I-A, Report, p. 180.

[2] Registrar-General's Estimate of India's Population for 1961 and 1966, New Delhi: Office of the Registrar-General, 1959.

TABLE 15-1

Population Projections of Shri R. A. Gopalaswami based on 1951 Census

(Figures in Thousands)

Year	All ages			0—14		15—54		55+	
	Persons	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
				COMPOSITE MADRAS STATE					
1921 ...	40,593	20,060	20,533	7,672	7,648	10,763	11,252	1,625	1,633
1931 ...	44,650	22,091	22,559	8,744	8,641	11,771	12,302	1,576	1,616
1941 ...	49,831	24,796	25,035	9,773	9,633	13,233	13,575	1,790	1,827
1951 ...	57,016	28,419	28,597	10,334	10,291	15,599	15,804	2,486	2,502
1961 ...	64,231	32,028	32,203	12,234	12,122	16,915	17,172	2,879	2,909
1971 ...	70,173	35,023	35,150	13,055	12,937	18,831	19,033	3,137	3,180
1981 ...	79,429	39,648	39,781	15,279	15,086	20,986	21,306	3,383	3,389
				PRESENT MADRAS STATE					
1961 ...	33,935	16,919	17,016	6,463	6,406	8,936	9,073	1,520	1,537
1971 ...	37,069	18,501	18,568	6,896	6,834	9,948	10,054	1,657	1,680
1981 ...	41,959	20,944	21,015	8,071	7,969	11,086	11,255	1,787	1,791

death rates may be assumed to be the same as that given by the appropriate U.N. Model Life Tables. The Ratio Method implies that the past trends in fertility, mortality and migration will continue in the future, and does not facilitate adjustments for any deviations that we could expect. This is perhaps responsible for the larger margin of error as revealed by the 1961 Census in these Projections for the State.

TABLE 15-2

The Expert Committee's Population Projections for Madras State, 1956-66

(Population in Millions as on 1st March)

Age Group	1956		1961		1966	
	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)
0—14 ...	6.05	6.00	7.00	6.88	8.14	7.93
15—64 ...	9.81	9.75	10.57	10.45	11.51	11.32
65+ ...	0.47	0.50	0.53	0.55	0.59	0.67
All ages ...	16.33	16.25	18.10	17.88	20.24	19.92

Source: A Study of Population Growth in India with an analysis of its economic implications: Central Statistical Organisation, New Delhi, June 1960 (mimeographed).

(3) *Vaidyanathan's Projections:* These projections attempted just at the same time as the Census of 1961 was in progress had to rely upon the evidences that were available till that time. The provisional population figures of the 1961 Census have influenced the author in formulating assumptions regarding the trends in migration. The basic assumptions were (*a*) Mortality will decline in such a manner that the expectation of life at birth will improve from 37.5 in 1946 to 52.5 in 1966 in the first instance and thereafter at a slower rate to the final level of 60.4 in 1981. (*b*) In the "High" Projections, the general fertility rate was assumed to remain constant at its 1951 level, *viz.*, 150 per 1,000 women in the age group 15 to 44. In the "Low" Projections, the general fertility was assumed to be stable till 1966 and thereafter it will decline linearly from 150 in 1966 to 90 in 1981. (*c*) A deduction of 4% of the projected male and female population was made for out-migration.

According to these projections, the population of Madras in 1961 should be 33.77 millions and it was expected to increase to 36.91 millions in 1966. Under the assumption of constant fertility, the population is expected to increase to 40.56 millions in 1971 and 49.65

millions in 1981. In the case of a decline in fertility setting in 1966 and taking place in the manner postulated in the "low" projections, the population is expected to go up to 40.17 millions in 1971 and 45.75 millions in 1981. It has been suggested that the "low" projections will be more befitting the situation in 1971 and 1981 if migration and mortality components were to follow the patterns assumed in the projections.

TABLE 15-3

Vaidyanathan's Projections for Madras State, 1961-81

(*Figures in Lakhs*)

Projections	1961	1966	1971	1976	1981
(1)	(2)	(3)	(4)	(5)	(6)
(1) "*High*" *Projections:*					
(*a*) Without migration ...	351.8	384.5	422.5	466.0	517.2
(*b*) Estimated number of out-migrants ...	14.1	15.4	16.9	18.6	20.7
(*c*) With migration ...	337.7	369.1	405.6	447.4	496.5
(2) "*Low*" *Projections:*					
(*a*) Without migration ...	351.8	384.5	418.4	449.0	476.6
(*b*) Estimated number of out-migrants ...	14.1	15.4	16.7	18.0	19.1
(*c*) With migration ...	337.7	369.1	401.7	431.0	457.5

Source: Population Projections for Madras State, 1961-81. Demographic Training and Research Centre, Bombay, 1961 (mimeographed).

Basic data for the present projections

The basic data used in this chapter are:—

(1) The age-sex distribution in 1961 of the Madras population adjusted for discrepancies in age reporting constitutes our base population. We have adopted the smoothed age distribution worked out by Shri Jain in the Census of India Paper No. 2, 1963 (Age Tables) for purposes of conformity with similar projections for the rest of India. The recorded and graduated age-sex distributions of population are presented in Table 15-4.

(2) The Abridged Life Tables for Madras State computed in Chapter VI were used for obtaining the Survival Ratios for the State as in 1956 and for projecting them.

(3) Evidences regarding fertility and mortality levels based on vital registration and Census data have been taken into account. An evaluation of the present levels of fertility and mortality has been attempted in earlier chapters. These have indicated that the current General Fertility Rate is around 150 per thousand

TABLE 15-4

Reported and adjusted age-sex distribution for Madras State, 1961 Census

(*In Hundreds*)

Age group	Census count		Adjusted population	
	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)
0—4 ...	23,103	22,995	24,662	24,461
5—9 ...	21,602	21,472	20,056	19,787
10—14 ...	19,126	18,375	18,068	18,350
15—19 ...	14,386	14,146	16,587	17,205
20—24 ...	14,190	15,524	15,201	15,765
25—29 ...	13,901	15,235	13,764	14,153
30—34 ...	11,762	12,056	12,343	12,413
35—39 ...	11,401	10,813	10,959	10,465
40—44 ...	9,779	8,910	9,537	8,823
45—49 ...	8,397	7,615	8,035	7,409
50—54 ...	7,123	6,818	6,502	6,047
55—59 ...	4,854	4,399	5,020	4,713
60—64 ...	4,367	4,315	3,624	3,439
65—69 ...	2,187	2,088	2,342	2,254
70+ ...	2,919	2,988	2,410	2,476
A.N.S. ...	13	11	...	...
Total ...	169,110	167,760	169,110	167,760

Source: Census of India Paper No. 2 of 1963, 1961 Census 'Age Tables.'

women in the age group 15-44, corresponding to a birth rate of 35 per 1,000 of the population.

(4) Data on the progress of family planning are yet another important information needed for making appropriate assumptions regarding future fertility levels. The Family Planning Survey has shown that family planning has not yet made much headway even in Madras City and the situation is likely to be even more so in the rural areas of the State.

Assumptions involved in the Projections

The following assumptions were made:—

(1) *Mortality:* The past trend in mortality since 1921 shows that there has been a downward trend in

mortality in India. The estimated death rate for Madras for 1941–51 decade has been of the order of 22 per 1,000 of mid-decennial population and for the 1951–61 decade it has been shown that the death rate is likely to be of the order of 20 per 1,000. The small decline in the death rate in the last decade has been a bit baffling in the context of a more rapid decline in the case of India from around a level of 27 to the present level of around 20. But a more careful study of the mortality trends of demographically advanced countries clearly shows that the decline is rapid upto a certain stage, after which the rate of decline tapers off.

At the beginning of the last decade, Madras had been at a more advanced stage of the demographic transition than the rest of India and has already witnessed a larger decline in mortality than the rest of India. This has made any additional decline in mortality a difficult one. Further, there are practically no malarial pockets in the State, the elimination of which could lead to a large scale decline in mortality. These considerations will explain the smaller decline in mortality in Madras State than the rest of India during the last decade. This has a more important pointer to the future too. In terms of expectations of life, the mortality decline during the past decade has resulted in the improvement of the expectations of life at birth from around 35 in 1946 to around 40 in 1956, or about 0.5 per annum. It is therefore reasonable to assume that the same trend will continue and the expectation of life will rise to 52.5 in 1981 from the level of 40 in 1956. This is our assumption regarding mortality.

(2) *Fertility:* Unlike mortality there has been as yet no visible changes in fertility in recent years and so it is more difficult to anticipate future changes in fertility.

An examination of the child-women ratios and the estimated birth rates for 1941–51 and 1951–61 decades based on the Reverse Survival Method seems to indicate a birth rate of 35 in both the decades and a General Fertility Rate of 150 per 1,000 women in the age group 15–44. The Fertility Survey, with due allowance for undercount, seems to lead to the same conclusion. It appears reasonable to conclude that the General Fertility Rate at the base period is 150 per 1,000, and we have to make suitable allowances for changes in this rate in future. Family planning is still in its infancy in the State and it is too early to predict its impact on fertility. The Family Planning Survey of 1963–64 has not revealed any serious impact of the programme, and, therefore, it is difficult to imagine that a large scale decline in fertility will take place in the near future. But, there could be a small decline in fertility as a result of the past efforts and as the practice of contraception becomes more widespread the decline in fertility is likely to be accelerated. This is still a matter of conjecture and therefore it is felt desirable to have two sets of alternative assumptions. In the " high " projections, the general fertility rate was assumed to remain constant at the present level of 150 per 1,000 women in the age group 15–44. In the " low " projections, the general fertility rate was assumed to be stable till 1966 and thereafter it will decline slowly to 125 in 1976 and more rapidly to 100 in 1981. The decline is assumed to be linear.

(3) *Migration:* Migration is more difficult to predict than fertility and mortality and it is subject to wide fluctuations. Prior to 1941 migration has been outward; in the 1941–51 decade the trend of migration was reversed and the State received more migrants than the number who had gone out of the State. This was a phenomenon which was caused by the after-effects of the Second World War and the resurgent nationalism in Burma, Ceylon and Malaya which made many Madrasi migrants to return home. In the last decade, the position appears to have been reversed again and the percentage of migrants to the initial population of the decade is estimated to be around 4%. While it is difficult to predict whether the same situation would continue in the future, it is felt that a conservative assumption would be a 2% out-migration in every decade in relation to the initial population. This is based on a consideration of a possible return of Tamils from Ceylon in the next few decades and a reduced out-migration consequent on the growth of industries in the State.

Methodology of the Projections

Age-sex distribution is usually distorted due to age heaping and digital preferences. Shri S. P. Jain has computed the smoothed age distribution for all States,[1] for purposes of comparability with similar projections for other States and that of India. Shri Jain's distribution has been adopted here. The persons aged 70 and over were further broken up into those in 70–74, 75–79 and 80+ by applying the percentages of persons at these ages in stationary populations.[2]

The method adopted is the component method which expresses the population five years hence as a product of the current population in a given age group and a survival factor. More explicitly,

$$P^{t+5}_{x+5} = P^{t}_{x} \times S_{x}$$

where P^{t+5}_{x+5} is the population in the age group (x+5, x+10) at year t+5, P^{t}_{x} the population aged x at year t

[1] Census of India Paper No. 2, 1963—Age Tables.

[2] United Nations: Manual III, Methods of Population Projections by Sex and Age, p. 14.

and S_x the survival factor. The survival factor is projected by using the Madras Abridged Life Tables arrived at in Chapter VI, assuming that the decline in the mortality rates q_x since 1956, is proportionate to that indicated by Model Life Tables corresponding to $e_0^0=40.0$ and $e_x^0=52.5$. From the life table mortality rate (q_x) for 1956 and 1981 for each age group 0, 1–4, 5–9, etc., the mortality rates for the intervening quinquennia were derived on the assumption that the fall in mortality follows a linear relationship. The following approximate relations were used:

(1) $S_x = 1 - \dfrac{q_x+q_{x+5}}{2}$ for age groups 5–9 to 75–79

(2) $S_b=0.05+p_0\,(0.53+0.42\,p_{1-4})$

(3) $S_{0-4} = \dfrac{p_0\,p_{1-4}\,(1+p_{5-9})}{2\,S_b}$

(4) $S_{80+}=0.8\,S_{75-79}-0.1$.

The Projected Survival Ratios are presented in Table 15-5. From the 1961 base population, the population five years and above in 1966, ten years and above in 1971, etc., are calculated by multiplying by the corresponding survival ratios as worked out above. The persons in the age group 0–4 in 1966 are obtained as follows. First, the number of births in the preceding five years (five times the number of women in 15–44 multiplied by the assumed General Fertility Rate) was estimated and using the proportion of males and females at birth, this was broken up into the number of male and female births. Using the appropriate survival ratio at birth (P_b) the number of male and female survivors to the age group 0–4 in 1966 was obtained. A similar procedure was adopted for the age group 0–4 in 1971, 1976 and 1981.

TABLE 15-5

Projected Life Table Survival Ratios (P_x) for Madras State, 1961-81

Age Group	Males				Females			
	1961–66	1966–71	1971–76	1976–81	1961–66	1966–71	1971–76	1976–81
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Birth	.859284	.870212	.881189	.892215	.863694	.875242	.886836	.898478
0–4	.938712	.945289	.951889	.958480	.952011	.957371	.962719	.968048
5–9	.963642	.967690	.971738	.975786	.980039	.982362	.984685	.987008
10–14	.978707	.980945	.983183	.985421	.986251	.987785	.989319	.990853
15–19	.987859	.989005	.990151	.991297	.974027	.976822	.979617	.982412
20–24	.981813	.983548	.985282	.987017	.945328	.951337	.957346	.963356
25–29	.964534	.966973	.969111	.971850	.923323	.931942	.940561	.949180
30–34	.939610	.944693	.949775	.954858	.910376	.920517	.930658	.940799
35–39	.907297	.916705	.926113	.935521	.888529	.900805	.913081	.925357
40–44	.866722	.879463	.892203	.904944	.852022	.867230	.882438	.897646
45–49	.821174	.836603	.852031	.867460	.809240	.827147	.845054	.862961
50–54	.766184	.784070	.801956	.819842	.757689	.778215	.798741	.819267
55–59	.700102	.719723	.739343	.758964	.694637	.717765	.740893	.764021
60–64	.621318	.641993	.662667	.683342	.621109	.645665	.670221	.694777
65–69	.528249	.549825	.571401	.592977	.535245	.559945	.584645	.609345
70–74	.426833	.448255	.469677	.491099	.441237	.465118	.488999	.512879
75–79	.322034	.342103	.362172	.382241	.344281	.366745	.389209	.411673
80+	.157627	.173682	.189738	.205793	.175425	.193396	.211367	.229338

The Population Projections

The results of the study are presented in Table 15-7 and a summary of it is presented below:

TABLE 15-6

Estimated future population of Madras State, 1961-81

(Figures in Lakhs)

Projections	1966	1971	1976	1981
(1)	(2)	(3)	(4)	(5)
(1) '*High*' *Projections*:				
(*a*) Without migration ...	358.2	385.7	420.0	461.9
(*b*) Estimated out-migration (2%) ...	7.2	7.7	8.4	9.2
(*c*) With migration ...	351.0	378.0	411.6	452.7

TABLE 15-6—(*Contd.*)

Estimated future population of Madras State, 1961-81

(Figures in Lakhs)

Projections	1966	1971	1976	1981
(1)	(2)	(3)	(4)	(5)
(2) '*Low*' *Projections*:				
(*a*) Without migration ...	358.2	383.3	410.0	435.1
(*b*) Estimated out-migration (2%) ...	7.2	7.7	8.2	8.7
(*c*) With migration ...	351.0	375.6	401.8	426.4

TABLE 15-7

Population Projections by Sex and Age

(1) High Projections

(In Hundreds)

Age Group	Base population 1961		1966		1971		1976		1981	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0—4 ...	24,662	24,461	26,780	25,630	28,800	27,580	31,500	30,200	34,891	33,463
5—9 ...	20,056	19,787	23,151	23,287	25,315	24,537	27,414	26,552	30,192	29,235
10—14 ...	18,068	18,350	19,327	19,392	22,403	22,876	24,600	24,161	26,750	26,207
15—19 ...	16,587	17,205	17,683	18,098	18,959	19,155	22,026	22,632	24,241	23,940
20—24 ...	15,201	15,765	16,386	16,758	17,489	17,679	18,772	18,765	21,834	22,234
25—29 ...	13,764	14,153	14,925	14,903	16,116	15,943	17,232	16,925	18,528	18,077
30—34 ...	12,343	12,413	13,276	13,068	14,432	13,889	15,618	14,995	16,747	16,065
35—39 ...	10,959	10,465	11,598	11,300	12,542	12,029	13,707	12,926	14,913	14,107
40—44 ...	9,537	8,823	9,943	9,298	10,632	10,179	11,615	10,983	12,823	11,961
45—49 ...	8,035	7,409	8,266	7,517	8,745	8,064	9,486	8,982	10,511	9,859
50—54 ...	6,502	6,047	6,598	5,996	6,915	6,218	7,451	6,815	8,229	7,751
55—59 ...	5,020	4,713	4,982	4,582	5,173	4,666	5,546	4,967	6,109	5,583
60—64 ...	3,624	3,439	3,515	3,274	3,586	3,289	3,825	3,457	4,209	3,795
65—69 ...	2,342	2,254	2,252	2,136	2,257	2,114	2,376	2,204	2,614	2,402
70—74 ...	1,451	1,488	1,237	1,206	1,238	1,196	1,290	1,236	1,409	1,343
75—79 ...	689	709	619	657	554	561	581	585	634	634
80+ ...	270	279	265	293	258	298	250	281	274	305
Total ...	169,110	167,760	180,803	177,395	195,414	190,273	213,289	206,666	234,908	226,961
Deductions for out-migration (2%) ...	3,382	3,355	3,616	3,548	3,908	3,805	4,266	4,133	4,698	4,539
Net population ...	165,728	164,405	177,187	173,847	191,506	186,468	209,023	202,533	230,210	222,422

TABLE 15-7—(*Contd.*)

Population Projections by Sex and Age

(2) Low Projections

(*In Hundreds*)

Age Group	Base population 1961		1966		1971		1976		1981	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0—4 ...	24,662	24,461	26,780	25,630	27,599	26,437	27,561	26,417	26,170	25,098
5—9 ...	20,056	19,787	23,151	23,287	25,315	24,537	26,271	25,451	26,417	25,573
10—14 ...	18,068	18,350	19,327	19,392	22,403	22,876	24,600	24,161	25,635	25,120
15—19 ...	16,587	17,205	17,683	18,098	18,959	19,155	22,026	22,632	24,241	23,940
20—24 ...	15,201	15,765	16,386	16,758	17,489	17,679	18,772	18,765	21,834	22,234
25—29 ...	13,764	14,153	14,925	14,903	16,116	15,943	17,232	16,925	18,528	18,077
30—34 ...	12,343	12,413	13,276	13,068	14,432	13,889	15,618	14,995	16,747	16,065
35—39 ...	10,959	10,465	11,598	11,300	12,542	12,029	13,707	12,926	14,913	14,107
40—44 ...	9,537	8,823	9,943	9,298	10,632	10,179	11,615	10,983	12,823	11,961
45—49 ...	8,035	7,409	8,266	7,517	8,745	8,064	9,486	8,982	10,511	9,859
50—54 ...	6,502	6,047	6,598	5,996	6,915	6,218	7,451	6,815	8,229	7,751
55—59 ...	5,020	4,713	4,982	4,582	5,173	4,666	5,546	4,967	6,109	5,583
60—64 ...	3,624	3,439	3,515	3,274	3,586	3,289	3,825	3,457	4,209	3,795
65—69 ...	2,342	2,254	2,252	2,136	2,257	2,114	2,376	2,204	2,614	2,402
70—74 ...	1,451	1,488	1,237	1,206	1,238	1,196	1,290	1,236	1,409	1,343
75—79 ...	689	709	619	657	554	561	581	585	634	634
80+ ...	270	279	265	293	258	298	250	281	274	305
Total ...	169,110	167,760	180,803	177,395	194,213	189,130	208,207	201,782	221,297	213,847
Deduction for out-migration (2%) ...	3,382	3,355	3,616	3,548	3,884	3,783	4,164	4,036	4,426	4,277
Net population ...	165,728	164,405	177,187	173,847	190,329	185,347	204,043	197,746	216,871	209,570

According to these projections, the population of Madras will be 35.1 millions in 1966 and it will increase to 37.8 millions in 1971 and 45.3 millions in 1981 under assumptions of constancy of fertility. If fertility decline takes place as postulated in the projections, the population in 1971 will be 37.6 millions and it will further rise to 42.6 millions in 1981.

CHAPTER XVI

PROSPECTS, PERSPECTIVES AND POLICIES

In this chapter, we propose to examine the evidences thrown by the earlier chapters and their implications on economic and social changes in the State. Population growth affects the social and economic development in three ways. One is by the operation of the mere magnitude of numbers which affects the *per capita* availability of food, clothing and other consumer goods. Secondly, changes in fertility and mortality and the consequent changes in age structure results in changes in the labour force and the population at school-going and older ages. Thirdly, the re-distribution of population within the State brings in its wake problems of housing and re-ordering of other basic amenities. This last aspect is a subject which requires deeper study and has not been attempted here. The discussion here is therefore confined to the first and second of these three aspects of demographic change.

Population Growth—Trends and Prospects

We may look at the population projections obtained in the last chapter along with the past trends in the growth of Madras population discussed earlier. The results are presented in Table 16–1. This table shows that Madras population has been fluctuating in the past. In the 1911–21 decade, the increase in population was only 3.5% as against 8.6% in the earlier decade. This low increase was due to the heavy mortality in the influenza epidemic of 1918–19. Since 1921, the rate of increase of population has grown steadily but in 1951–61 we find a fall in the rate of increase from 14.7% in 1941–51 to 11.9% in 1951–61. This fall in the percentage increase in spite of a lower level of mortality in this decade is mainly attributable to a reversal of the migration trends. In the 1941–51 decade, Madras State had witnessed a heavy influx of migrants—mostly those of Madras origin who had gone to Burma, Ceylon and Malaya and who were obliged to return to the State as a result of unsettled conditions in those countries as an aftermath of the Second World War and also due to the resurgent nationalism which looked upon Madrasis as aliens. In the 1951–61 decade, this movement had more or less stopped, but on the other hand the growth of industries in the adjoining States of Mysore and Andhra and in centres like Calcutta and Bombay had led to a large scale out-migration of Madrasis to these areas. Traditionally, Madras population is a mobile one when compared to the rest of India. Enough evidence of this is found in the Tamil speaking population enumerated in South Africa, West Indies, Malaya, Ceylon and Burma. The tea estates in Assam used to recruit their labour force from Madras State. Therefore, a large scale out-migration of the scale noticed in 1951–61 is not surprising. At this stage a point deserves mention. Prior to 1921, the fluctuation in the rate of growth of the State's population is mainly attributable to the sudden and unforeseen visitations of epidemics and famines. These factors have been largely controlled and the prospects of future mortality trends appear to be much more definite. On the other hand, the chief factor affecting future population growth of the State will be migration; but, unfortunately it is this component of population growth that is least amenable to prediction. Moreover, as discussed in an earlier chapter, there has been no consistent trend in the operation of this factor in the past. The projections presented earlier assume that there will be an out-migration of 2% per decade in future and this

TABLE 16–1

Growth of Population in Madras State, 1901-81

Year		Population (in lakhs)	Percentage increase in preceding decade
(1)		(2)	(3)
1901	...	192.5	...
1911	...	209.0	8.6
1921	...	216.3	3.5
1931	...	234.7	8.5
1941	...	262.7	11.9
1951	...	301.2	14.7
1961	...	336.9	11.9
1971			
(1) "High" Projection.		378.0	12.2
(2) "Low" Projection.		375.6	11.5
1981			
(1) "High" Projection.		452.7	19.8
(2) "Low" Projection.		426.4	13.5

assumption has been made since the conditions in Ceylon may lead to a heavy return migration of people of Madras origin in the next few decades, and also because the growth of heavy industries in the State will diminish the influx of skilled workmen of the State to other States. The actual prospect of fertility decline is obscure and it will remain so for a long time. No appreciable change in fertility has been visible so far, nor can we expect that a decline beginning in 1966 would be rapid enough to halve the birth rate by 1981. The general fertility rate is at present about 150 births per 1,000 women in the age group 15 to 44. Any decline in fertility is likely to be slow in the beginning and more rapid later. Our low assumption therefore implies that the General Fertility Rate will decline slowly at first to 125 in 1976 and more rapidly thereafter to 100 in 1981. Our conjecture is that a decline in fertility on these lines is more probable than the constant fertility assumption implied in the "high" projections. Hence, the probable estimate will be the one based on the "low" assumptions given here, so far as can be judged by present indications and the growth rate will be around 11.5% in 1961–71 and 13.5% in 1971–81.

Vital rates implied in the projections

The crude birth and death rates and the rates of natural increase implied in the population projection worked out in the earlier chapter are presented in Table 16–2. These rates have been calculated by dividing the average number of births and deaths during each five-year interval by the average population of the period.

TABLE 16–2

Birth, Death and Natural Increase Rates, 1961-81

Period		Birth Rate	Death Rate	Natural Increase Rate
(1)		(2)	(3)	(4)
1961-66	...	35.0	22.6	12.4
1966-71 (1) High	...	34.7	19.9	14.8
„ (2) Low	...	33.4	19.8	13.6
1971-76 (1) High	...	34.6	17.6	17.0
„ (2) Low	...	30.8	17.3	13.5
1976-81 (1) High	...	34.6	15.6	19.0
„ (2) Low	...	27.2	15.3	11.9

It appears that the birth rate will remain constant around a level of 35 in the "high" projections whereas it declines to 27.2 in 1976–81 in the "low" projections. The death rate is around 22.6 in 1961–66 and it declines to 15.6 in 1976–81 in the "high" projections and to 15.3 in the "low" projections. The behaviour of the rate of natural increase is interesting. In the "high" projections, the rate of natural increase is increasing steadily from 12.4 in 1961–66 to 19.0 in 1976–81. On the other hand, in the "low" projections, the rate of natural increase rises from 12.4 in 1961–66 to 13.6 in 1966–71 and then declines to 11.9 in 1976–81. This clearly brings out the impact of alternative levels of fertility on the rate of natural increase. In either series, the population growth is likely to be higher than the present level unless there is out-migration of a high order.

The expectation of life at birth

Our basic mortality assumption in the population projections discussed earlier is that the expectation of life at birth will improve at the rate of 0.5 per annum. The approximate expectations of life at birth for five-year intervals for the period covered by the projections are given in Table 16–3.

TABLE 16–3

Expectations of life at birth, Madras State, 1961-81

Period		Males	Females
(1)		(2)	(3)
1951—61	...	39.85	38.24
1961—66	...	43.60	41.99
1966—71	...	46.10	44.49
1971—76	...	48.60	46.99
1976—81	...	51.10	49.49

The table shows that our projections imply an increase in expectation of life at birth from the present level of 40 to a level of 51 in 1976–81. The present levels of expectancy of life in the State are far below the levels prevalent in several of the demographically advanced countries in the early 1900s.

TABLE 16-4

Expectation of life at birth by sex, 21 countries, Circa 1900 and 1950

Country	Males			Females		
	Circa 1900	Circa 1950	Gain in years	Circa 1900	Circa 1950	Gain in years
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Austria ...	39	62	23	41	67	26
Belgium ...	45	62	17	49	67	18
Denmark ...	53	68	15	56	70	14
England & Wales ...	49	66	17	52	71	19
Finland ...	45	63	18	48	70	22
France ...	45	64	19	49	69	20
Germany, West ...	45	65	20	48	68	20
Hungary ...	37	59	22	38	63	25
Iceland ...	48	66	18	53	70	17
India ...	23	32	9	24	32	8
Ireland ...	49	65	16	50	67	17
Japan ...	44	61	17	45	65	20
Netherlands ...	51	71	20	53	73	20
New Zealand ...	58	68	10	61	72	11
Northern Ireland ...	47	65	18	47	69	22
Norway ...	55	69	14	58	73	15
Spain ...	34	59	25	36	64	28
Sweden ...	55	69	14	57	72	15
Switzerland ...	49	66	17	52	71	19
Trinidad & Tobago ...	37	60	23	39	63	24
United States ...	48	65	17	51	71	20

Source: U.N. Demographic Year Book, 1957, (p. 5.)

Sex composition of population, past and future

The sex composition of the population is determined by a number of factors such as the proportion of the sexes at birth, the differential mortality as between the sexes and the sex selective nature of migration. It is usual to measure the difference in the numbers between the sexes by an index called the sex ratio. In what follows, the number of females per 1,000 males is referred to as the sex ratio. A picture of the trends in the sex composition of the Madras population in the past and future will be evident from Table 16-5.

TABLE 16-5

Sex composition of Madras population, 1901-81

Year	Population in lakhs			Sex ratio
	Males	Females	Total	
(1)	(2)	(3)	(4)	(5)
1901 ...	94.2	98.3	192.5	1,044
1911 ...	102.4	106.6	209.0	1,042
1921 ...	106.6	109.7	216.3	1,029
1931 ...	115.8	118.9	234.7	1,027
1941 ...	130.6	132.1	262.7	1,012
1951 ...	150.0	151.2	301.2	1,007
1961 ...	169.1	167.8	336.9	992
1971				
(1) "High" ...	191.5	186.5	378.0	973.9
(2) "Low" ...	190.3	185.3	375.6	973.7
1981				
(1) "High" ...	230.2	222.4	452.6	966.1
(2) "Low" ...	216.9	209.6	426.5	966.3

Before 1961, there was a predominance of the females over the males in numbers in the State and this was contrary to the situation in India as a whole. The proportion of females in the population has declined steadily in the past and according to our projections will continue to decline in the future unless altered by the selectivity of migration. A similar decline in the proportion of females is noticeable for India as well. Since there is no room for suspicion that omission in Census enumeration is sex selective, the observed sex ratio may be presumed to portray the correct situation. According to the projections attempted here, there will be 974 females per 1,000 males in 1971 and in the year 1981, the sex ratio will be around 966 in both high and low projections.

Apart from biological factors, it appears that there is an association between sex ratio and the level of fertility. This is corroborated by the fact that except for a few countries in South America, male excess has been observed in the majority of the under-developed countries which are well-known for their high levels of fertility. It is of interest to examine the sex ratio at birth and also among deaths as available from the

registration data. The sex ratio at birth was 1,077 males per 1,000 females in 1957 and during the same period the sex ratio for the registered deaths was 1,004 males for 1,000 females. This shows that male predominates over the female both at birth as well as at death. This is true of most countries of the world including the demographically advanced countries; but the difference lies in the fact that the proportion of female deaths to total deaths in India and perhaps in many under-developed countries is far higher than the proportions in the demographically advanced countries. It is known that there is the imbalance in the sex ratio in India, and its decline could be traced to the sex ratio among deaths. As a plausible hypothesis for this imbalance, we have advanced the reason that high maternal mortality is responsible for the abnormal sex ratio at death which in turn leads to a decline in the overall sex ratio. This is a subject which deserves wider analysis.

The implications of a lower proportion of females in the population are manifold. The proportion of women has a bearing on fertility and the proportion of working population. In a society where females are dependents on men for their subsistence, the existence of a high proportion of females at advanced ages presents problems of social security and old age insurance. In the past, the extended family system acted as a social security measure in protecting the dependents belonging to the older ages. As there is a feeling that the extended family system is fast declining, it is possible that any imbalance in the sex composition especially at advanced ages may aggravate the problem of old age security.

A phenomenon witnessed in recent times in India is a rapid decline in the proportion of married and a rise in the age at marriage. This is especially true of Madras where the average age at marriage has been among the highest attained by any State in India. As the institution of marriage depends upon the association of both the sexes, the sex composition plays a very important role in the community. Even though sex composition may be affected by social institutions (*e.g.*, female infanticide practised by primitive societies) as well as biological factors (*e.g.*, sex differentials in mortality and at birth), any imbalance in the sex composition may lead to changes in the incidence of marriage and consequently on the institution of marriage itself. In India, where caste endogamy is prevalent and marriages take place only within each caste, any imbalance in the sex composition in the marriageable ages among different communities will considerably affect the incidence of marriage in these communities. While an institutional factor like the dowry system may no doubt lead to a rise in the age at marriage, it appears that the effect of this factor on the incidence of marriage will be important. This is a subject which requires more detailed study by special sample surveys.

Age structure of the population

The age structure of a population is governed by demographic factors alone, at least directly. Although these demographic factors are themselves influenced by economic and social conditions, it is through the demographic factors that these influences affect the age structure. In other words, the age structure is modified only to the extent that economic and social factors cause changes in births, deaths and migrations. If we know the operation of the factors—fertility, mortality and migration, we can anticipate the probable changes in the age structure. Variations in one may take place with or without any change in the other two.

As a consequence of high fertility and high mortality, Madras has an extremely young population. The age pyramid reveals a very broad base which tapers off rapidly in the higher ages. This is in marked contrast to the population pyramids of countries with low fertility and low mortality. A comparison with the population of U.S.A., reveals that there are only 30% of people under age 15 in U.S.A., while according to the present study the corresponding percentage for Madras is 36 during 1961. Elderly persons (aged 60 and over) are in larger proportion in U.S.A., the proportion being twice as that in Madras. The detailed future changes in the age structure implied in the population projections are summarised for broad age groups in Table 16-6.

TABLE 16–6

Percentage distribution of Madras population by broad age groups, 1921-81

Year	Males			Females		
	0–14	15–59	60+	0–14	15–59	60+
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1921 ...	37.8	56.3	5.9	37.0	57.1	5.9
1931 ...	39.3	56.0	4.7	38.2	57.3	4.5
1941 ...	39.1	56.4	4.5	38.4	57.0	4.6
1951 ...	36.2	58.3	5.5	36.2	58.1	5.7
1961 ...	37.7	56.7	5.6	37.5	56.9	5.6
1971						
'High' ...	39.2	56.8	4.0	39.4	56.7	3.9
'Low' ...	38.8	57.2	4.1	39.1	57.0	3.9
1981						
'High' ...	39.1	57.0	3.9	39.2	57.1	3.7
'Low' ...	35.4	60.5	4.1	35.4	60.6	4.0

It appears from this table that the percentage of population in the age group 0–14 will slightly increase during 1961–71 and thereafter it will continue to be around 39% if no decline in fertility takes place. On the other hand, if fertility declines as postulated in the "low" projections, the percentage in this age group will reduce to 32 in 1981. Similarly, according to the "high" projections, the percentage in the age group 15–60 will continue at a level of 57%. On the other hand, if a fertility decline takes place after 1966 in the manner assumed in the "low" projections, the percentage in this age group will rise to 60% in 1981. In both the series there will be a decline in the percentage of persons in the ages 60 and over.

The changes in age structure appear more significant when calculated in relation to one age segment of the population rather than to the total. The usual index is the dependency ratio which expresses the number in the 0–14 and 60+ age groups as a ratio of the number in 15–59 years, multiplied by 100. The dependency ratios of Madras State for 1921–81 are presented below :

TABLE 16–7

Dependency Ratios for Madras State, 1921-81

Year	Population (in lakhs)			Dependency Ratios		
	Under 15 (P_{0-14})	15–59 (P_{15-59})	60 & over (P_{60+})	$x=\frac{P_{0-14}}{P_{15-59}} \times 100$	$y=\frac{P_{60+}}{P_{15-59}} \times 100$	x + y
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1921	80.9	122.6	12.8	66.0	10.4	76.4
1931	91.0	133.0	10.7	68.4	8.0	76.4
1941	101.7	149.0	12.0	68.3	8.1	76.4
1951	109.0	175.4	16.8	62.1	9.6	71.7
1961	126.7	191.3	18.9	66.2	9.9	76.1
1971 High	151.5	218.8	15.3	69.2	7.0	76.2
Low	140.2	218.8	15.4	64.1	7.0	71.1
1981 High	180.7	263.5	17.6	68.6	6.7	75.3
Low	154.0	263.5	17.6	58.4	6.7	65.2

It appears that in 1961 there were 66 children per 100 young and middle aged adults and in 1981, this will become 69 if fertility continues at the same level, and 59 if fertility declines. In 1961, there were 10 persons aged 60 and over per 100 adults of working age; in 1981 this will be seven. If there is no decline in fertility, the burden of dependency in 1981 will be heavier than at present. On the other hand, a decline in fertility as postulated in our projections will reduce it by 10%.

Labour Force Projections, 1961-81

Labour force is one of the most important determinant of economic and social progress of any country, and the utilisation of man-power is one of the most important factors in planning and policy making. We have therefore attempted a set of labour force projections for Madras State upto 1981 and we have examined the implied changes in the labour force over the period. Methodologically, there are several limitations in the projections of labour force and the most refined method involves two factors: (1) a set of population projections and (2) a schedule of age-specific labour force participation rates for males and females separately. Given these data, the projected population in each age group is multiplied by the corresponding participation rate, which after accumulation, gives an estimate of the labour force. In Madras State as in the case of many of the developing areas of the world, considerably large proportions of those aged 0–14 and 15–19 are in the working force. This is due partly to the predominance of

agriculture disposed to accommodate the young on petty work, and partly to the poverty of the people that prevents sending their sons to schools and colleges. But with the constitutional provision for compulsory education upto 14 years, which will in many cases be accompanied by higher, college and university education, the age at entry into the labour force is likely to rise considerably. As a consequence, we may anticipate that the proportion of economically active population in the age groups 15–19 and 20–24 will decline appreciably in future. Further, we may assume that the contribution of the age-group 0–14 will be negligible in future, which may perhaps lead to a slight underestimation of the future size of the labour force. The other important constituent group that invariably shows tendencies of decline as a result of economic transition is the old. We may therefore expect that the participation rates for ages 55 and over will decline in the years to come. As regards the middle age groups, no great change may be expected. Sri K. S. Gnanasekaran has derived certain participation rates for India in respect of males taking into account the current levels as well as the level of participation rates prevalent in countries at different stages of economic-demographic development. These projected participation rates for males are presented in Table 16–8.

TABLE 16–8

Projected age specific participation rates for Males, India, 1961-81*

Age group		1961	1966	1971	1976	1981
(1)		(2)	(3)	(4)	(5)	(6)
15—19	...	72.7	71.4	70.2	68.9	68.9
20—24	...	93.0	92.2	91.4	90.7	90.7
25—34	...	97.0	96.7	96.5	96.2	96.2
35—44	...	97.3	97.3	97.3	97.2	97.2
45—54	...	93.3	93.9	94.4	94.9	94.9
55—64	...	85.6	84.9	84.2	83.5	83.5
65+	...	47.7	45.2	42.9	40.6	40.6

* K. S. Gnanasekaran: Labour Force Projections. Arthavijnane—Vol. II, No. 1, March, 1960.

We have adopted these rates as true for the State as well. This is in respect of males only. As regards female labour force, we may well quote Sri Gnanasekaran's observations: "The participation of women in the labour force, though common in India and elsewhere, is far more complex a problem from the point of view of projection models because of their irregular and seasonal participation followed by withdrawal owing to maternity and child-care. In India, the proportion of women in the working force is considerable and exceeds that of many developed countries excepting Japan. Whether the pattern of development in India will also lead to increasing participation of women in the labour force is doubtful; it is considered safe to assume constancy of participation during the projection period. Underlying the assumption implicitly is also the reason that the growth of employment opportunities for women in the expanding secondary and tertiary sectors that is currently under way, will somewhat, though not precisely be offset by the diminution of women workers in agriculture, on account of say, rise in family income." The results of the projections are given below :

TABLE 16–9

Projected labour force of Madras State, 1961-81

Year		Males	Females	Total	Variation
(1)		(2)	(3)	(4)	(5)
1961	...	9,469,100	4,646,100	14,115,200	...
1966	...	9,911,100	4,855,400	14,766,500	651,300
1971	...	10,532,700	5,153,900	15,686,600	920,100
1976	...	11,414,100	5,615,300	17,029,400	1,342,800
1981	...	12,580,100	6,165,000	18,745,100	1,715,700

According to these projections, the male labour force in 1981 would be 125.8 lakhs which means an increase of 33% over the period 1961–81. The total labour force will also increase during the same period by 33%. The increase in the labour force in the quinquennial periods 1961–81 is shown in the last column of Table 16–9. We notice that the growth of labour force will itself accelerate in the next few decades, and this calls for labour-intensive measures in future plans, failing which there might be serious unemployment.

Policy aspects

Population has two aspects. On the one hand, it could be an instrument of economic growth, if it is utilised along with other resources. On the other hand population could either augment production or simply act as consumers of goods and services. Any realistic analysis should therefore take into account both aspects separately and in relation to each other. It is because

of the latter aspect *viz.*, as a consumer, that population is different from other resources like land, power, etc., the value of which will increase with their expansion. As a source, its utilisation, like the utilisation of any other resource, has its cost, namely the cost of combining it with other resources. The cost of idle manpower is reflected not only in production not accomplished and of the cost of maintenance but also in terms of the cost of consumption above maintenance, which is an unavoidable cost. Unemployment or underemployment is not only a failure to use the physical power of human beings to some optimum degree, but also the failure to use their faculties, inherited or acquired.

The Planning Commission's views on this subject are embodied in the following statement:

> " Under present conditions, an increase in manpower resources does not strengthen the economy but, in fact, weakens it. . . . Unless measures are initiated at this stage to bring down the birth rate and thereby to reduce the rate of growth, a continuously increasing amount of effort on the part of the community will be used only in maintaining the existing standards of consumption. . . . A population policy is therefore essential to planning."*

The report also points out that although the purpose of family planning is to reduce the rate of population growth, its immediate effect will be to improve public health. According to the Planning Commission, if the births are too frequent and poorly spaced, the health of both children and mother suffers, especially under conditions of poverty and malnutrition. Family Planning is thus doubly important—so much so that the State should according to this report encourage contraception by educating the public as to its necessity, providing medical attention and contraceptive advice to married couples, and sponsoring research for the scientific understanding of all aspects of family limitation.†

The Indian Government is perhaps one of the few Governments to take the courageous step of committing itself on birth limitation as part of its programme.

One major consequence of a prospective spread of family planning and the attendant reduction in the birth rate would be a reduction in the maternal mortality. As we have pointed out in an earlier chapter the total number of maternal deaths in the State exceeds the number of deaths due to small-pox. And while the latter is dreaded by the society, little is felt by the society as such by the occurrence of the death of a mother at confinement. A maternal death is taken for granted and is part of the Indian way of life. With the growth of literacy and education, the attitude towards maternal mortality is bound to change and the spread of contraception will also aid the reduction in the maternal death rate.

* First Five Year Plan. Planning Commission, Govt. of India (p. 16.)

† *Ibid.*, (pp. 206–207).

APPENDIX I
System of Registration of Births and Deaths in Madras State

Area covered	Provisions or Rules regarding registration of Vital Statistics and Agency for registration of Vital Statistics	Obligations imposed on Registrars or private persons for bringing on record vital events	Provisions for checks and registration of omitted cases	Method of correcting clerical errors and registering omitted cases
1. Madras City ...	Madras City Municipalities Act, 1919. Under the rules framed under this Act, the Commissioner of the Corporation of Madras shall divide the City into such and so many districts of registration as he shall think fit and shall appoint a person to be the Registrar of Births and Deaths within each such district. In Madras City, ten Medical Officers have been appointed as Births and Deaths Registrars and they are assisted by 28 Clerks in the scriptory work relating to the registration of births and deaths.	The father or mother of every child born in the City, or the midwife assisting at the birth or every adult male member of the family resident in the house in which the child was born, shall within one week after the day of such birth, give or cause to be given either orally, or in writing, information of the birth to the Registrar of the district. If any child is born in any hospital, the medical officer-in-charge shall forthwith send to the Registrar a notice in writing of the occurrence. As regards death, the nearest adult male relative present at the death or in attendance during the last illness of any person dying in the City of Madras or every adult male present at the death, or the occupier of the house, if such occupier is an adult male person living in the house in which such death has happened, shall, within thirty-six hours after the death give or cause to be given, either orally or in writing, information to the Registrar of the district. Every medical attendant, who attended on any person during his or her last illness, shall if such person has died in the City, within three days of his becoming aware of such death give information to the municipal health officer and to the Registrar of Births and Deaths in the district. Every person who performs or has performed the funeral ceremonies of a person who died in the City, shall whenever required, furnish to the Registrar, information as he possesses of the particulars required for registration. Under Rule 1 (*b*) of the Rules framed under the Madras City Municipality Act, 1919,	The out-door staff of the Health Department, when they come across any cases of omission to register births or deaths, report the events to the Registrar of the districts concerned.	Clerical error found in the register of births or in the register of deaths, shall be corrected by the Registrar, if the error is discovered by him, and by both the Registrar and the checking officer (Commissioner or the Health Officer of the Corporation) if the error be discovered by the checking officer, provided that no entry shall be corrected under this rule more than a year after it is made, except with the previous sanction of the Commissioner. Where any case of omission to register a birth or death is discovered by or brought to the notice of the Registrar or the Health Officer, he shall, after ascertaining on such enquiry as he may deem fit, register the same or cause the same to be registered provided that no registration shall be made after the expiry of one year from the birth or death. A birth or death not registered within one year after its occurrence shall be registered only under the orders of a Magistrate not below the rank of a Magistrate of the first class.

		it is also the duty of the Registrar to inform himself carefully of every birth and death which occurs in the district for which he is appointed and shall register with as little delay as possible the particulars required to be registered touching every birth and death which has not been registered. Whoever commits a breach of the above rules, shall be punishable with fine, which may extend to Rs. 100/-		
2. Municipal Areas ...	Madras District Municipalities Act, 1920. Under Section 286 of the Act, the Municipal Council shall register all births and deaths occurring in the Municipality, and for this purpose the Council may divide the Municipality into districts of registration and shall appoint a person to be the Registrar of Births and Deaths for the whole municipality, or in the case of a division of a municipality into districts, for every such district. In the municipalities, persons who possess the qualifications of Sanitary Inspector are appointed Registrars of Births and Deaths. Vaccinators are also appointed as Births and Deaths Registrars.	The father or mother of a child born in the municipality, or the registered medical practitioner, vaidyan, hakim, midwife, nurse or thai who assisted at the birth, or the occupier of the building in which the child was born shall within one week after the day of such birth, give or cause to be given, information of the birth to the Registrar of the municipality or the district. In the case of deaths, the nearest adult relative present at the death, or in attendance during the last illness of any person dying in the municipality, or every adult person present at the death, or the occupier of the building in which the death occurs, or every adult person living in the building in which the death occurs, shall within 36 hours after the death, give information to the Registrar of the municipality or district. In addition, any registered medical practitioner, vaidyan or hakim in attendance during the last illness of any person dying in the municipality shall, within three days of his becoming aware of the death of the person, send a notice to the executive authority in the prescribed form. Any person who performs the funeral ceremonies of a person dying within the municipality, shall whenever required furnish the Registrar such information as he possesses of the particulars required for registration.	The Sanitary Inspectors help in the work of registration of births and deaths by enquiry during their inspections and bring to account cases of any reported births and deaths not yet registered. One of the duties of Municipal Health Officer is to institute necessary measures to ensure accurate registration of births and deaths. In municipalities which do not employ separate Health Officers, the District Health Officer shall scrutinise the returns of Vaccination and Vital Statistics and take such action as he considers necessary, for remedying any defects. During the hot season of every year, vaccination is suspended. During the cessation period, vaccinators are asked to check the birth and death registers and submit returns.	Clerical error or omission of any particular in any entry relating to a birth or death already registered shall be corrected, or rectified by the checking officer, if the error or omission is discovered by the Registrar, provided that no such error or omission shall be corrected or rectified more than a year after the original entries were made, except with the previous sanction of the Collector of the district. Any other error in the said registers shall be corrected under the orders of a Magistrate, not below the rank of a Magistrate of the second class having jurisdiction over the municipal area. If any case of birth or death is discovered or brought to the notice of the Registrar or the checking officer, he shall after enquiry register the same, or cause the same to be registered, provided that no registration shall be made after the expiry of one year from the birth or death. A birth or death not registered within one year after its occurrence, shall be registered only under the orders of a Magistrate not below the rank of a Magistrate of the second class having jurisdiction over the municipal area.

APPENDIX I—(*Contd.*)

System of Registration of Births and Deaths in Madras State—(*Contd.*)

Area covered	Provisions or Rules regarding Registration of Vital Statistics and Agency for registration of Vital Statistics	Obligations imposed on registrars or private persons for bringing on record vital events	Provisions for checks and registration of omitted cases	Method of correcting clerical errors and registering omitted cases
2. Municipal areas—(*Contd.*)		Any person who commits a breach of any of the rules shall be punishable with fine, which may extend to Rs. 20/- and in the case of continuing breach, with fine which may extend to Rs. 5/- for every day the breach continues after conviction after the first breach or after receipt of notice from the executive authority to discontinue such breach subject to a maximum of one hundred rupees.		
3. Cantonment Area ...	Cantonment's Act, 1924. Registration of Vital Statistics within the Cantonment Area is carried on by the Executive Officer under the by-laws framed by the Cantonment Board, under the provision of the Act.		The out-door staff of the Cantonment exercise, checks over the births and deaths within the Cantonment area.	Any clerical error, which may be discovered in any register of births or deaths may be corrected by the Executive Officer. Any error of fact or substance in any register of births or deaths may be corrected by the Executive Officer, by an entry in the margin, without any alteration in the original entry, on the production by the person requiring such correction of a declaration on oath or solemn affirmation, setting forth the nature of the error and the true facts of the case made before a Magistrate of the first class.
4. Panchayat Areas ...	(1) Madras Registration of Births & Deaths Act (Act III) 1899. (2) Madras District Municipalities Act, 1920. (3) Board's Standing Order No. 101. Village headmen carry on the work of registration of births and deaths. If the panchayat covers more than one village, then the headman of each village maintains a	Under Section 8 of Act III of 1899, the father of every child, or the midwife assisting at the birth, or other adult male member of the family resident in the house in which the child was born, or any person having charge of the child, or in the absence of the above, the mother, shall, within two weeks after the day of such birth give or cause to be given, either orally, or in writing to the Registrar the several particulars required to be entered	Under Section 15 of the Madras Registration of Births & Deaths Act, 1899, it shall be the duty of every Registrar to inform himself carefully of everyb irth and of every death, which takes place in his village, plantation or ward and he shall ascertain and register, as soon as conveniently may be after the event, the parti-	Rules 10 and 11 of the rules framed under Section 20 of Act III of 1899, lay down the procedure for correcting errors or any omission of any particular, in any entry relating to a birth or death already registered or for registering any cases of omission to register a birth or death by a Registrar himself or by a checking officer.

register relating to his village in the panchayat, where a panchayat appoints a special Registrar of Births and Deaths and applies to the Government for the extension of the provisions of the Madras District Municipalities Act, 1920, within the panchayat limits. The Government withdrew the provisions of the Madras Registration of Births and Deaths Act, 1899 in these panchayats and extended in their place the provisions of the Madras District Municipalities Act, 1920. Some District Health Officers have brought to notice that in some panchayats where the District Municipalities Act, 1920 is in force, the registration work is being performed by the Panchayat ward clerks who are not executive officers.

In other rural areas where Act III of 1899 is applicable, the executive instructions contained in the Board's Standing Order No. 101 are applicable. In such areas the village officers are appointed as Births and Deaths Registrars and they attend to the registration of births and deaths.

in the birth register.

In the case of deaths, the nearest adult male relative present at the death, or in attendance during the last illness of any person dying in a village or plantation or every adult male person present at the death, or the occupier of the house, or every adult male person living in the house in which the death has happened, or the person undertaking the disposal of the corpse, shall within 4 days from the date of death, give or cause to be given, either orally or in writing information to the Registrar.

For failure to give information, a person shall on conviction, before a Magistrate be liable to a fine not exceeding Rs. 10/-.

In Section 28 of Chapter V of the Village Officers and Ryots Manual, it is stated that the Vetti and Talayari of the village, who should be aware of all occurrings in the village must find out all births and deaths which have occurred and report them at once to the headman, who is the Registrar for the time being to enable him to make the necessary daily entries. This will not, however relieve the headman from the duty of making enquiries himself. The enquiries should be made as soon as possible after the occurrence of birth or death, as the case may be. The Registrar should not be satisfied by waiting till the birth or death is reported to him, but should make frequent enquiries so as to make the entries in the registers complete and correct.

culars required for such registration. The Registrar should not be satisfied by waiting till the birth or death is reported to him, but should make frequent enquiries, so as to make the entries complete and correct.

Under Public Health Code (Vol. I), it is the duty of the Health Inspector to inspect the birth and death registers of the villages he visits and check their completeness and accuracy by house to house enquiry [Para. 21 (*d*), Section III, Chapter III].

Where there are Asst. District Health Officers, it is their duty to check Vital Statistics and vaccination in rural areas. The District Health Officer has also to examine and verify the village Vital Statistics by a scrutiny of the registers and by house to house enquiry, as far as possible.

In other rural areas according to paragraph 4 of the Board's Standing Order No. 101, it is the duty of the Tahsildar, Dy. Tahsildar and Revenue Inspector to scrutinise their registers during the tours and to verify a certain number of entries by local enquiry and to punish or bring to notice any instances of neglect on the part of the village officers. They sholud initial

Under these rules, a checking officer means :—

(i) Any officer of the Public Health Department not below the rank of a vaccinator, in cases where correction is to be made before the expiry of one year after the original entry has been made and in the case of omissions before the expiry of one year from the birth or death.

(ii) The Taluk Tahsildar, Dy. Tahsildar in independent charge of a Taluk or a Sub-Magistrate in cases where a correction has to be made more than a year after the original entry, with the previous sanction of the Collector of the district and

(iii) A Revenue Inspector of the Firka in which the village concerned is situated in the case of other errors in the registers, and in the case of births and deaths not registered within one year after their occurrence, under the orders of a Magistrate not below the rank of a Magistrate of the second class having jurisdiction over the local area.

In areas where Act III of 1899 is not applicable, if the Registrar detects any clerical error in the registers of births and deaths within a year after the entry was made, he should correct the error in the register concerned immediately. A similar

APPENDIX I—(*Contd.*)

System of Registration of Births and Deaths in Madras State—(*Contd.*)

Area covered	Provisions or Rules regarding registration of Vital Statistics and Agency for registration of Vital Statistics	Obligations imposed on Registrars or private persons for bringing on record vital events	Provision for checks and registration of omitted cases	Method of correcting clerical errors and registering omitted cases
4. Panchayat Areas—(*Contd.*)			and date the entries in the registers which they verified. Collectors and Divisional Officers have to see that the registers are carefully examined during their tours and at the time of the Jamabandi, the accuracy of the entries have to be checked by questioning the assembled ryots. Another excellent check prescribed by the Board is that a trustworthy official should be deputed to take a census of all children in a village under one year of age and to compare the results with the register of births.	procedure should be followed by the checking officers, if they detect errors, within a year after the entry was made. If the error is detected more than one year after the entry was made, the sanction of the Collector should be obtained. If any error other than those mentioned above is detected the order of a Magistrate not below the rank of a Magistrate of the second class should be obtained, for correcting the error. If the Registrar detects any case of omission to register a birth or death or if any omission is brought to his notice within a year after the birth or death took place, he should register the birth or death in the register. A similar procedure should be followed by the checking officers. If any case of omission to register is detected after a lapse of one year after the event, the orders of a Magistrate not below the rank of a Magistrate of the second class should be obtained.

APPENDIX II

Birth Registration Form under Madras Act III of 1899

(AS PER RULES FRAMED UNDER THE MADRAS REGISTRATION OF BIRTHS AND DEATHS ACT, 1899)

Register of births during the year...........in.......................village of.................taluk of.................district

Annual number	Monthly number	Date of		Particulars of the child				Names and residence of parents to whom the child is born		
		Birth	Registration	Male	Female	Nationality and Caste	Name, if any	Father's name	Mother's name	Residence
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

APPENDIX II—(*Contd.*)

Birth Registration Form under Madras Act III of 1899—(*Contd.*)

Annual number	Monthly number	Age of mother at confinement	Number of the livebirth	Particulars of the informant			Signature or mark of the informant, if the information is given orally	Signature of the Registrar	Remarks
				Name	Description	Residence			
		(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)

Note : (1) If a child is born dead, the entries should be made in red ink without being given any serial numbers and such cases should be excluded from the totals in the compilation of the returns.

(2) In making the entries in column (7), it should be stated whether the child born is a Hindu and, if so, of which caste and sub-caste, or a Muhammadan or an Indian Christian or of an other religion or an Anglo-Indian or a European British subject or a foreigner and, if so, of what nationality.

(3) In the case of illegitimate births, the word 'Illegitimate' should be entered in the remarks column and no person's name should be entered as that of the father except as provided in the second proviso to Section 8 of the Madras Registration of Births and Deaths Act, 1899.

APPENDIX III

Death Registration Form under Madras Act III of 1899

(AS PER RULES FRAMED UNDER THE REGISTRATION OF BIRTHS AND DEATHS ACT, 1899)

Register of deaths during the year....................in.................village of................ taluk of.............. ...district

		Date of		Particulars relating to the deceased							
						Age					
Annual number	Monthly number	Death	Registration	Name with the name of both the parents	Residence at the time of death	Years	Months	Days	Male or Female	Nationality and Caste	Born dead
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

APPENDIX III—(*Contd.*)

Death Registration Form under Madras Act III of 1899—(*Contd.*)

		Particulars relating to the deceased—(*Contd.*)						
		Cause of death						
Annual number	Monthly number	All maternal deaths occurring during child-birth or within one month thereof	Cholera	Plague	Hydrophobia	Cerebro-spinal meningitis	Diphtheria	Small-pox
		(13)	(14)	(15)	(16)	(17)	(18)	(19)

APPENDIX III—(*Contd.*)

Death Registration Form under Madras Act III of 1899—(*Contd.*)

Annual number	Monthly number	Particulars relating to the deceased—(*Contd.*)										
		Cause of death—(*Contd.*)										
		Measles	Malaria	Other Fevers	Respiratory diseases	Dysentery	Diarrhoea	Suicides	Wounds and accidents	Snake-bites	Killed by wild beasts	All other causes
		(20)										
		(*a*)	(*b*)	(21)	(22)	(23)	(24)	(25)	(26)	(27)	(28)	(29)

APPENDIX III—(*Contd.*)

Death Registration Form under Madras Act III of 1899—(*Contd.*)

Annual number	Monthly number	Particulars of the informant			Signature or mark of the informant if the information is given orally	Signature of the Registrar	Remarks (Note in this column the exact cause of death in case of the deaths registered under all other causes).
		Name	Description	Residence			
		(30)	(31)	(32)	(33)	(34)	(35)

Note : (1) If a child is born dead, the entries should be made in red ink without being given any serial numbers and such cases should be excluded from the totals in the compilation of the returns.

(2) In making the entries in column (11), it should be stated whether the person deceased was a Hindu, and, if so, of which caste and sub-caste, or a Muhammadan or an Indian Christian or of any other religion or an Anglo-Indian or a European British subject or a foreigner and, if so, of what nationality.

APPENDIX IV

Birth Registration Form under the Madras District Municipalities Act, 1920

(AS PER RULES FRAMED UNDER THE MADRAS DISTRICT MUNICIPALITIES ACT, 1920)

Register of births in the Municipality of............................during the month of............................19

Annual number	Monthly number	Name of child, if any	Born alive		Born dead		Nationality and Caste	Where born		
			Male	Female	Male	Female		Door number	Street number	Number of Ward or Division
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

APPENDIX IV—(*Contd.*)

Birth Registration Form under the Madras District Municipalities Act, 1920—(*Contd.*)

Annual number	Monthly number	Name of Father	Name of Mother	Age of mother at confinement	Number of the live-birth	Occupation of the father or mother	Date of birth	Date of registration	Informant's	
									Mark or signature	Residence
		(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)

APPENDIX IV—(*Contd.*)

Birth Registration Form under the Madras District Municipalities Act, 1920—(*Contd.*)

Annual number	Monthly number	Informant of the name of the child: Relationship and his mark or signature	Informant of the name of the child: Residence	Signature of Registrar	Midwife or doctor who attended the birth: Name	Midwife or doctor who attended the birth: Qualified or unqualified in the case of midwife	Remarks
		(21)	(22)	(23)	(24)	(25)	(26)

Note : (1) In making the entries in column (8), it should be stated whether the child born is a Hindu, and, if so, of which caste, and sub-caste or a Muhammadan or an Indian Christian or of any other religion or an Anglo-Indian or a European British subject, or a foreigner and, if so, of what nationality.

(2) In the case of illegitimate births the word 'Illegitimate' should be entered in the remarks column and no person's name should be entered as that of the father except as provided in clause (*e*) of the proviso to sub-rule (1) of rule 5.

APPENDIX V

Death Registration Form under the Madras District Municipalities Act, 1920

(AS PER RULES FRAMED UNDER THE MADRAS DISTRICT MUNICIPALITIES ACT, 1920)

Register of deaths in the Municipality of........................during the month of........................19 .

Annual number	Monthly number	Name of deceased	Name of father	In the case of a married woman or a widow, the name of the husband	Sex: Male	Sex: Female	Age: Years	Age: Months	Age: Days	Nationality and Caste
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

APPENDIX V—(*Contd.*)

Death Registration Form under the Madras District Municipalities Act, 1920—(*Contd.*)

Annual number	Monthly number	Occupation	Residence at time of death			Cause of death	Date of death	Date of registration
			Door number	Street	Ward or Division			
		(12)	(13)	(14)	(15)	(16)	(17)	(18)

APPENDIX V—(*Contd.*)

Death Registration Form under the Madras District Municipalities Act, 1920—(*Contd.*)

Annual number	Monthly number	Informant's		Signature of Registrar	Name of burial or burning ground	Name of medical attendant (if any)	Remarks
		Mark or Signature	Residence				
		(19)	(20)	(21)	(22)	(23)	(24)

Note: (1) In the case of persons born illegitimate, the mother's name should be entered in column (4).

(2) In making the entries in column (11), it should be stated whether the person deceased was a Hindu, and, if so, of which caste and sub-caste, or a Muhammadan or an Indian Christian or of any other religion or an Anglo-Indian or a European British subject or a foreigner and, if so, of what nationality.

APPENDIX VI

Birth Registration Form in Madras City

(AS PER RULES FRAMED UNDER THE MADRAS CITY MUNICIPAL ACT, 1919)

1. Annual number ...
2. Monthly number ...
3. Name of child ...
4. Born alive .. (*a*) Male
   (*b*) Female
5. Born dead ... (*a*) Male
   (*b*) Female
6. Nationality or Caste.
7. Where born ... (*a*) Door number
   (*b*) Street
   (*c*) Division
8. Father ... (*a*) Name
   (*b*) Age
   (*c*) Occupation
   (*d*) Address
9. Mother ... (*a*) Name
   (*b*) Age
   (*c*) Occupation
   (*d*) No. of children of this mother including this child
   - (i) born alive—
   - (ii) now alive / dead
   - (iii) still born
10. Informant ... (*a*) Signature or mark
    (*b*) Address
11. Mid-wife who attended the birth ... (*a*) Name
    (*b*) Qualified or unqualified
    (*c*) Address
12. Doctor who attended the birth ... (*a*) Name
    (*b*) Address
13. Date of birth ...
14. Date of registration.
15. Signature of the Registrar.
16. Remarks ...

APPENDIX VII

Death Registration Form in Madras City

(AS PER RULES FRAMED UNDER THE MADRAS CITY MUNICIPAL ACT, 1919)

1. Annual number ...
2. Monthly number ...
3. Name of deceased ...
4. Nationality or Caste ...
5. Sex ... (*a*) Male
   (*b*) Female
6. Age ... (*a*) Years
   (*b*) Months
   (*c*) Days
7. Social condition ... (*a*) Single
   (*b*) Married
   (*c*) Widowed
8. Occupation ...
9. Usual residence ... (*a*) Door number
   (*b*) Street
   (*c*) Division
10. Place of death ...
11. Cause of death ...
12. Duration of illness ...
13. Date of death ...
14. Date of registration ...
15. Informant ... (*a*) Signature or mark
    (*b*) Address
16. Name of the burial or burning ground or crematorium where the body was disposed of ...
17. Name and the address of the medical attendant who attended during last illness ...
18. Signature of the Registrar
19. Remarks ...

APPENDIX VIII

FORMAT OF THE WEEKLY POSTING REGISTER FOR MUNICIPAL AREAS WITH POPULATION OVER 30,000

Vital Statistics Recorded in the Municipal Towns in Madras State with a population of 30,000 and above for the week ending..............................19 .

Serial Nos. and Municipal Towns	Mid-year estimated populations for 19	Births		Deaths from				
		Live	Still	Cholera	Small-pox	Plague	Fevers	Dysentery and Diarr-hoea
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

APPENDIX VIII—(*Contd.*)

FORMAT OF THE WEEKLY POSTING REGISTER FOR MUNICIPAL AREAS WITH POPULATION OVER 30,000—(*Contd.*)

Serial Nos. and Municipal Towns	Deaths from—(*Contd.*)					Rates per 1,000 of estimated populations		Infant deaths
	Respiratory Diseases	Injuries	Child-Birth	Other causes	Total	Birth	Death	
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)

APPENDIX IX

FORMAT OF THE MONTHLY POSTING REGISTER FOR MUNICIPAL TOWNS

Vital Statistics Recorded in the Municipal Towns in the State of Madras for the month of............19 .

Districts	Sl. No.	Municipal Towns	Population as per Census of 1951	Births: Number registered excluding still births	Births: Still-born number registered	Deaths from: Cholera	Deaths from: Small-pox	Deaths from: Plague	Deaths from: Malaria	Deaths from: Fevers	Deaths from: Dysentery and Diarrhoea
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

APPENDIX IX—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR MUNICIPAL TOWNS—(*Contd.*)

Districts	Sl. No.	Deaths from—(*Contd.*)							Total deaths in the corresponding month of previous year		
		Respiratory diseases	Injuries including suicides	Deaths from child birth	Other causes	Total: Males	Total: Females	Total: Total	Males	Females	Total
		(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)

APPENDIX IX—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR MUNICIPAL TOWNS—(*Contd.*)

Districts	Sl. No.	Deaths according to ages											
		Under one year		1—5 years		5—10 years		10—15 years		15—20 years		20—30 years	
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
		(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)

APPENDIX IX—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR MUNICIPAL TOWNS—(*Contd.*)

Districts	Sl. No.	Deaths according to ages—(*Contd.*)										
		30—40 years		40—50 years		50—60 years		60 and above		Total		
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Total
		(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)

APPENDIX X

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS

Births and Deaths Posting Book........................Taluk........................District, Month..................19 .

(*Exclusive of the Statistics of Municipal Areas only*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Births									
		Classes							Total Births		
		European British Subjects	Foreigners	Anglo-Indians	Indian Christians	Hindus	Muslims	Other classes	Males	Females	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Still-births		Deaths by Classes							
				European British Subjects		Foreigners		Anglo-Indians		Indian Christians	
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
		(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Deaths by Classes—(*Contd.*)						Deaths by Causes					
		Hindus		Muslims		Other classes		Cholera		Small-pox		Plague	
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
		(23)	(24)	(25)	(26)	(27)	(28)	(29)	(30)	(31)	(32)	(33)	(34)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Deaths by Causes—(*Contd.*)												
		Malaria		Other fevers		Dysentery & Diarrhoea		Respiratory Diseases		Deaths from Child Birth	Suicide		Wounds & Accidents	
		Males	Females	Males	Females	Males	Females	Males	Females	Females	Males	Females	Males	Females
		(35)	(36)	(37)	(38)	(39)	(40)	(41)	(42)	(43)	(44)	(45)	(46)	(47)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Deaths by Causes—(*Contd.*)								Total Deaths		
		Snake-bites		Killed by wild beasts		Rabies		All other causes				
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Total
		(48)	(49)	(50)	(51)	(52)	(53)	(54)	(55)	(56)	(57)	(58)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Deaths by Ages							
		Under one year							
		Over one week		One week & upwards but under one month		Over one month & not exceeding 6 months		Over 6 months and not exceeding 12 months	
		Males	Females	Males	Females	Males	Females	Males	Females
		(59)	(60)	(61)	(62)	(63)	(64)	(65)	(66)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Deaths by Ages—(*Contd.*)							
		Total		One year and under 5 years		5 years and under 10 years		10 years and under 15 years	
		Males	Females	Males	Females	Males	Females	Males	Females
		(67)	(68)	(69)	(70)	(71)	(72)	(73)	(74)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Deaths by Ages—(*Contd.*)									
		15 years and under 20 years		20 years and under 30 years		30 years and under 40 years		40 years and under 50 years		50 years and under 60 years	
		Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
		(75)	(76)	(77)	(78)	(79)	(80)	(81)	(82)	(83)	(84)

APPENDIX X—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR RURAL AREAS—(*Contd.*)

Census number of village from which "Nil" returns were received	Census number of village for which births and deaths returns were received	Deaths by Ages —(*Contd.*)		Deaths from Small-pox						Remarks
		60 years and upwards		Under one year		One year and upwards but under ten years		10 years and upwards		
		Males	Females	Males	Females	Males	Females	Males	Females	
		(85)	(86)	(87)	(88)	(89)	(90)	(91)	(92)	(93)

APPENDIX XI

FORMAT OF THE MONTHLY POSTING REGISTER FOR NON-MUNICIPAL TOWNS

Vital Statistics of the Census Towns with a population of 10,000 and over in the State of Madras for the month of...........19 .

District	Sl. No.	Census Towns	Population under registration according to the Census of 1951	Births		Deaths		
				Number registered excluding still-births	Still-born number registered	Cholera	Small-pox	Plague
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

APPENDIX XI—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR NON-MUNICIPAL TOWNS—(*Contd.*)

District	Sl. No.	Census Towns	Deaths—(*Contd.*)					
			Malaria	Fevers	Dysentery & Diarrhoea	Respiratory diseases	Injuries including suicides	Deaths from child births
			(10)	(11)	(12)	(13)	(14)	(15)

APPENDIX XI—(*Contd.*)

FORMAT OF THE MONTHLY POSTING REGISTER FOR NON-MUNICIPAL TOWNS—(*Contd.*)

District	Sl. No.	Census Towns	Deaths—(*Contd.*)				Birth Rate	Death Rate
			Other Causes	Total Deaths				
				Males	Females	Total		
			(16)	(17)	(18)	(19)	(20)	(21)

APPENDIX XII

EXPLANATORY NOTE ON THE REVISED BIRTH REGISTER FOR RURAL AREAS

A copy of the Revised Register of Births is enclosed. The modifications made in the existing register of births are explained below:

(i) A new column (5) of the revised register is provided for entering the residence where a child was actually born. This has been introduced so that figures of births on a residential and non-residential basis may be separately compiled.

(ii) In view of the instruction contained in paragraph 8 of the Government Order, one Register of Births for Indian Nationals only will be maintained. And, as per G.O. Ms. No. 1726, Public (Services–A) dated 16th October, 1961, particulars about caste should not be entered in official register. Hence, column (7) of the present register showing "Nationality and Caste" of the child has been deleted.

(iii) The particulars about the father and the mother of the child have been separately grouped together. In respect of mother, provision is made for entering information on type of attendance at confinement. This is necessary to extend the maternity and child welfare services in rural areas. Hence, three columns, (12), (13) and (14) have been provided for entering particulars as to whether the confinement took place in institutions (hospitals, maternity homes, nursing homes, etc.), or at home and if latter, whether attended by a qualified mid-wife or not.

(iv) In accordance with instructions contained in G.O. Ms. No. 1726, Public (Services–A), dated 16th October, 1961, particulars about the religion and the community of the father are required to be collected. Hence, column (16) showing religion (Hindus, Muhammadans, Christians and others) has been included. Another column, (17), showing the Community (Scheduled Castes, Scheduled Tribes, most Backward Class, other Backward Class and others) has also been included.

REVISED BIRTH REGISTRATION FORM

Register of Births during the year............in........................Village in.................Taluk in..............District

Annual Number	Monthly Number	Date of Birth	Date of Registration	Residence where the child was born	Particulars of Child		
					Sex		
					Male	Female	Name
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

APPENDIX XII—(*Contd.*)

REVISED BIRTH REGISTRATION FORM—(*Contd.*)

Annual Number	Monthly Number	Particulars of Mother					
		Name	Age at Confinement	Order of live birth	Type of attendance at confinement		
					Institutional	Domiciliary	
						Skilled	Unskilled
		(9)	(10)	(11)	(12)	(13)	(14)

APPENDIX XII—(*Contd.*)

REVISED BIRTH REGISTRATION FORM—(*Contd.*)

Annual Number	Monthly Number	Particulars of Father				Particulars of Informant				Signature of Registrar	Remarks
		Name	Religion	Community	Residence	Name	Description	Residence	Signature or mark of Informant		
		(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)

Note : (1) If a child is born dead, the entries should be made in red ink without giving any registration number and such case should be exoluded from the totals in compilation of birth and death returns.

(2) If the child is still born, the words "still birth" should be entered in the remarks column.

(3) In the case of illegitimate birth, the word "illegitimate" should be entered in the remarks column and no person's name should be entered as that of father except as provided in second proviso to Section 8 of Act III of 1899.

APPENDIX XIII

EXPLANATORY NOTE ON THE REVISED DEATH REGISTER FOR RURAL AREAS

A copy of the Revised Register of Deaths prescribed for rural areas under the rules issued for registration of births and deaths under Act III of 1899 is enclosed. The changes made in the death register are explained below .—

(i) In view of the instructions contained in paragraph 8 of the Government Order, one Register of Deaths for Indian Nationals only will be maintained. And, as per G.O. Ms. No. 1726, Public (Services–A), dated 16th October, 1961, particulars about caste should not be entered in the official register. Hence, column (11) showing nationality and caste in the present death register has been deleted.

(ii) In accordance with instructions contained in G.O. Ms. No. 1726, Public (Services–A), dated 16th October, 1961, particulars about the religion and the community of the father are required to be collected. Hence, column (10) showing religion (Hindus, Muhammadans, Christians and others) has been included. Another column (11) showing the Community (Scheduled Castes, Scheduled Tribes, most Backward Class, other Backward Class and others) has also been included.

(iii) In the existing Register of Deaths, 18 columns are provided for entering the causes of deaths so that a village headman may enter the particular cause of death under the relevant column. The village headman has not sufficient medical knowledge to diagnose deaths from cerebro-spinal meningitis, diphtheria, etc. The list of causes of deaths may therefore be simplified so that certain specified causes of deaths with which he is familiar and other groups giving the causes of deaths in general like fevers, respiratory diseases, etc., may also be given. In the case of unspecified groups of diseases, he may record the symptoms of the disease at the time of death under the Remarks column in the Register of Deaths. Instead of 18 columns in the present Death Register one column alone need be provided. A list of specified and unspecified groups of causes will be printed in the fly-leaf of the Register. The village headman may refer to this list, decide the particular cause as per the list and enter it in column (16), Cause of death

(iv) In the present Register of Deaths, there is only one column to show the residence of the deceased at the time of death. In addition to this, a new column (14) has been opened in the revised register to show the permanent residence of the deceased. This has been introduced with a view to collect the figures of deaths as per residential and non-residential basis.

REVISED DEATH REGISTRATION FORM

Register of Deaths during the year............in..................Village in..............Taluk in......................District

				Particulars of the deceased						
Annual Number	Serial Number	Date of Death	Date of Registration	Name	Male	Female	Name of Father/ Husband of deceased	Name of the Mother	Religion	Community
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)

APPENDIX XIII—(*Contd.*)

REVISED DEATH REGISTRATION FORM—(*Contd.*)

Annual Number	Serial Number	Particulars of the deceased—(*Contd.*) Age						
		Years	Months	Days	Residence at time of death	Permanent residence	Born dead	Cause of death (See list of causes on fly leaf)
		(12*a*)	(12*b*)	(12*c*)	(13)	(14)	(15)	(16)

APPENDIX XIII—(*Contd.*)

REVISED DEATH REGISTRATION FORM—(*Contd.*)

Annual Number	Serial Number	Particulars of Informant					
		Name	Description	Residence	Signature or mark of Informant	Signature of the Registrar	Remarks
		(17)	(18)	(19)	(20)	(21)	(22)

Note :—(1) If a child is born dead, the entries should be made in red ink without giving any registration number and such case should be excluded from the totals in compilation of birth and death returns.

(2) If the child is still born, the words "still birth" should be entered in the remarks column.

APPENDIX XIV

INSTRUCTIONS REGARDING THE CONDUCT OF AN AD HOC CENSUS OF BIRTHS AND DEATHS FOR ESTIMATING THE MID-YEAR POPULATION OF RURAL AREAS IN EACH BLOCK FOR 1962

I. Method of Estimation of Population: The population of an area will be increased by births and immigrants and reduced by deaths and emigrants. The mid-year population may therefore be determined, by the following arithmetical computation: population of the area at the last Census, plus the number of births, minus the number of deaths that occurred since the last Census upto the mid-year, plus the number of immigrants, minus the number of emigrants during the same period. This estimate will be accurate provided the last Census figures and statistics of all births and deaths that occurred in the area since the last Census and particulars of migration are accurately available. It is proposed to employ this method to estimate the mid-year population in the rural area in each Block for 1962. Data regarding migration are not available. Moreover, as far as rural areas are concerned, the net effect of migration is likely to reduce the population by a negligible number. Hence, the migration factor may be omitted. As the last Census population is known, the question therefore resolves to one of obtaining the correct number of births and deaths that occurred during the period from the 1st March, 1961—the date of last Census to the 30th June, 1962. This is a long interval. It is, therefore, not likely that people will remember all the vital events that occurred during this period. It is, therefore, proposed to ascertain the births and deaths that occurred during a period of about six months which may be considered as optimum for making a reliable estimate therefrom. People generally remember events better in relation to any important festival. It is, therefore, proposed to find out the number of births and deaths that occurred during the period from the Pongal day (the 14th January, 1962) to the 30th June, 1962. From these figures, the number of births and deaths for the period from the 1st March, 1961 to the 30th June, 1962 may be computed.

II. Agency employed: The number of births and deaths that occurred should be available from the registration records. But, it is common knowledge that the registration of births and deaths is incomplete. In order to ensure complete registration of all births and deaths occurring in rural areas, a new procedure has been laid down in G.O. Ps. No. 3142, Rural Development and Local Administration, dated the 24th November, 1961. According to this, the Presidents of Panchayats and the Panchayatdars are requested to take an active part in this work of registration of births and deaths in their areas which have now been made as units of registration. They are required to review the births and deaths registered in the birth and death registers at the first meeting of each month and notify any unregistered birth or death from their personal knowledge. It is proposed to make use of this agency for the present investigation.

III. Operation of the Scheme: Role of Panchayatdars.—On an average, there may be about 300 households and about ten Panchayatdars in a panchayat village with an average population of 1,500. Out of the total number of births and deaths that may occur in a panchayat village, it is expected that the Registrars of Births and Deaths may register about 70 per cent to 80 per cent of the events. It will be the responsibility of the Panchayatdars to detect and bring on record the unregistered events which in all probability may not exceed two to three in a month in each panchayat village. The President of the Panchayat may suitably allocate the number of households in the panchayat area to the Panchayatdars. The number of households allotted to each may be about 30 to 40. They may be requested to enquire from each head of the household or other person whether any birth or death actually occurred in his or her residence during the period from the 14th January to the 30th June, 1962. Any birth or death that occurred outside the panchayat area, but subsequently brought into the area should be omitted. It is expected that it should be possible for the Panchayatdars to complete this enquiry in about four or five days. In case a Panchayatdar is unable to visit all households allotted to him, he shall state in Form C, the number of households visited by him and the number allotted to him.

In order to keep the work of the Panchayatdars to the minimum and to facilitate their work, each Registrar of Births and Deaths of a panchayat village/town shall prepare a statement of births and another statement of deaths in the Forms A and B respectively (copy enclosed) giving the particulars about the births and deaths that occurred and registered during the period from the 14th January to the 30th June, 1962. The Registrar should prepare on the 1st July, 1962, as many copies of these statements A and B as there are Panchayatdars and give one copy to each of them. Each Panchayatdar will check up the entries of births and deaths registered

to have occurred in the households allotted to him during his enquiry. If any unregistered birth and death is detected, he shall enter the particulars of the event in the blank forms C and D (copy enclosed) supplied to him. The President of the Panchayat shall call for a special meeting on the 7th July, 1962. The Registrar of Births and Deaths shall also be present at the meeting. The Panchayat will then review the registered births and deaths and pass on to the Registrar of Births and Deaths statements C and D containing particulars of unregistered births and deaths detected by them.

IV. Duties of the Registrars of Births and Deaths: As stated in the previous paragraph, the Registrar of Births and Deaths will prepare on the 1st July, 1962, a statement of births and another statement of deaths registered from the 14th January, 1962 to the 30th June, 1962, in Forms A and B (copy enclosed), take required number of copies of each of the statements and give one copy to each of the Panchayatdars. In preparing these statements, the Registrar shall enter all events relating to one revenue village and then those relating to another village and so on. This will help the Panchayatdars in locating easily the registered birth or death in the list during their rounds of enquiry. He should certify on each copy that the statement includes all registered births and deaths that occurred in the panchayat village/town during the period. In the case of panchayat village/town comprising more than one revenue village, he should also certify that the statement includes registered births and deaths that occurred in all the revenue villages constituting the panchayat area during the period.

The Registrar of Births and Deaths should also attend the meeting of the Panchayat on the 7th July, 1962, mentioned above, clarify any points raised by the Panchayatdars, receive the statements of unregistered births and deaths, verify the particulars of unregistered births and deaths and register them immediately. He should prepare a statement in Form E (copy enclosed) and submit it in duplicate to the Commissioner of the Panchayat Union concerned by the 14th July, 1962.

V. Duties of the Presidents of the Panchayats and Chairmen of the Panchayat Unions: The Chairman of each Panchayat Union Council and the Presidents of all Panchayats in the Union shall arrange for a meeting on the 5th and 6th June, 1962, when the Health Inspector will explain to them the scheme of Census of births and deaths, etc. The Presidents of Panchayats shall in turn arrange for a similar meeting of Panchayatdars on the 10th and the 11th June, 1962, and explain to them the scheme. At the time of this training, he will equitably allocate the households in the Panchayat village/town among the Panchayatdars for enquiry, taking care to see that no household is left out.

VI. Duties of Commissioners of Panchayat Unions: The Commissioner of a Panchayat Union shall obtain from the Registrar of Births and Deaths of all Panchayat villages/towns in the block the statements in Form E. The figures of births and deaths given in the Statement E shall be compiled in Form F (copy enclosed). He shall forward it to the Director of Public Health direct so as to reach him by 21st July, 1962, along with the duplicate copies of Form E sent by the Registrars. The services of the Health Inspector of the Panchayat Union shall be fully utilised for this purpose.

In the case of Panchayat towns which have taken up the work of registration of births and deaths by extending the relevant provisions of the Madras District Municipalities Act, the same procedure described above for the Panchayat village/town shall be followed.

VII. Supervision: The actual enquiry will be conducted by the Panchayatdars during the first week of July, 1962. It is necessary that the field work is supervised. The Chairmen of Panchayat Union Councils and the Commissioners of Panchayat Unions, if they happen to visit any Panchayat village, should see whether the scheme is properly implemented. The District Family Planning Officers and the Health Inspectors of the Panchayat Unions should each visit at least five Panchayats, test-check the work of the Panchayatdars and submit a report to the Director of Public Health by the 10th July, 1962, on the defects noticed, the difficulties met with, etc., in each of the Panchayats visited by them.

VIII. Training of the personnel: In order to ensure that this Birth and Death Census Scheme is properly implemented, necessary training will have to be given to the personnel concerned. The Statistician of the Public Health Department and the Director of Statistics, Madras, and the Deputy Superintendent of Census Operations, will explain the work of registration of births and deaths in rural areas and the scope of the scheme to the District Family Planning Officers, whose services are utilised for supervision of the conduct of the Census. This will form part of the course of training proposed to be given to them from the 6th April, 1962, by the Medical Department. Each District Family Planning Officer will in turn train the Health Inspectors of Panchayat Unions in two or three batches from the 1st to the 10th May, 1962. The Health Inspectors will in turn give necessary training to the village headmen in three batches from the 15th to the 31st May, 1962. The training of each batch of Health Inspectors or village headmen may last for one or two days.

IX. Printing and supply of forms: The Director of Public Health will be responsible for getting the forms prescribed for this scheme printed by the Controller of Stationery and Printing, Madras, and for supplying them to the Presidents of Panchayats, the Panchayatdars and the Registrars of Births and Deaths, through the Commissioners of Panchayat Unions so as to reach them by the 30th April, 1962.

Calendar for Implementing the Scheme of Census of Births and Deaths

1.	Preparation and issue of instructions ...	7th April, 1962
2.	Training of District Family Planning Officers ...	2nd week of April, 1962
3.	Printing and distribution of forms ...	30th April, 1962
4.	Training of Health Inspectors	1st to 10th May, 1962
	Training of Village Headmen	15th to 31st May, 1962
5.	Training of Presidents of Panchayats ...	5th and 6th June, 1962
	Training of Panchayatdars ...	10th and 11th June, 1962
6.	Census Enquiry ...	1st to 6th July, 1962
7.	Special Meeting of Panchayats ...	7th July, 1962
8.	Last date for submission of statement by the Registrars to the Commissioners of Panchayat Unions ...	14th July, 1962
9.	Last date for submission of Statement F by the Commissioner to the Director of Public Health ...	21st July, 1962
10.	Scrutiny, compilation and preparation of preliminary draft ...	31st August, 1962
11.	Submission of the Final Report by the Committee ...	15th September, 1962

FORM A

Statement showing births registered during the period from the 14th January to the 30th June, 1962 in.................Panchayat Village/Town in.................Taluk.................District

Name of the revenue village in the Panchayat area	Annual number in the birth register	Date of birth		Name of the mother of the child	Name of the father of the child	Community	Residence where the child was born	Remarks
		Live	Still					
(1)	(2)	(3)		(4)	(5)	(6)	(7)	(8)

Certificate

Signature of the Birth and Death Registrar

FORM B

Statement showing deaths registered during the period from the 14th January to the 30th June, 1962 in..............Panchayat Village/Town in..................Taluk..................District

Name of the revenue village in the panchayat area	Annual number	Date of death	Name of the deceased	Name of the father or the husband	Community	Age	Residence at the time of death	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Certificate

Signature of the Birth and Death Registrar

FORM C

Unregistered births that actually occurred during the period from the 14th January to the 30th June, 1962 and reported by Panchayatdars in..............Panchayat Village/Town in.................Taluk.................District

Serial number	Name of the revenue village	Date of birth	Residence where the child was born	Name of the mother of the child	Name of the father of the child	Community	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Number of households allotted

Number of households visited

Signature of the Panchayatdars

Signature of the President of the Panchayat

FORM D

Unregistered deaths that actually occurred during the period from the 14th January to the 30th June, 1962 and reported by the Panchayatdars in..................Panchayat Village/Town..................Taluk............District

Serial number	Name of the revenue village	Date of death	Name of the deceased	Name of the father or husband	Community	Age	Residence at the time of death	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Signature of the Panchayatdar

Signature of the President of Panchayat

FORM E

Statement showing births and deaths registered during the period from the 14th January to the 30th June, 1962

District ...

Name of Panchayat Village/Town

Taluk ...

Location Code No.

	Births: Alive	Births: Still	Deaths
Number recorded before scrutiny by the Panchayatdars ...			
Number reported by the Panchayatdars ...			
Total ...			

FORM E—(*Contd.*)

Statement showing births and deaths registered during the period from the 14th January to the 30th June, 1962—(*Contd.*)

Total Number of Households in the Panchayat ...

Total Number of Households visited by the Panchayatdars ...

Signature of Birth and Death Registrar.

The Commissioner,
Panchayat Union,

.... Panchayat Union

FORM F

Statement showing the births and deaths recorded in each Panchayat Village/Town in Panchayat Union during the period from the 14th January to the 30th June, 1962

Name of the Panchayat Union

District

Taluk

Name of Panchayat Village/ Town	Location Code Number of Panchayat Village/ Town	Number of live births		Number of still births		Number of deaths	
		Registered by Regis-trars	Reported by the Panchayat-dars	Registered by Registrars	Reported by the Pan-chayatdars	Registered by Registrars	Reported by the Pan-chayatdars
(1)	(2)	(3*a*)	(3*b*)	(4*a*)	(4*b*)	(5*a*)	(5*b*)

Total for the Block

Signature of the Commissioner, Panchayat Union

APPENDIX XV

ESTIMATION OF BIRTH RATE FOR MADRAS STATE DURING 1921-30, 1931-40, 1941-50 AND 1951-60

(Based on Census data)

1. Purpose and Scope of the Study

Population growth consists of three major components *viz.*, fertility, mortality and migration. All other factors—economic, sociological or biological affect them and operate through them. While attempting to explain the growth of population in the past, the first step will be to ascertain the relative contribution of these three variables and to analyse the forces affecting them. In the past, the lulls and spurts in the population growth have been governed largely by variations in mortality. If the population of the State has declined or remained static in a decade, the reason lay in a great catastrophe —a famine, an epidemic or a war—which took a heavy toll of human lives. If the population has grown in the remaining period, it was due to the absence of such large catastrophes. The last two decades have witnessed large scale measures to combat epidemics and even when allowance is made for large errors in the recording of deaths, it seems reasonably certain that the crude death rates in India have been declining.[1] One may therefore expect that before the end of this decade the mortality rates will get stabilised at a very low level and as a consequence the reasons for future levels of population growth will largely lie on the trends in fertility and migration.

Among these two factors, evidence regarding the pattern and extent of migration is perhaps the least available and inadequately analysed. Since migration offers no possible solution to the population problem of any region, an alternative solution to the problem of large population lies in the control of fertility. Consequently, an understanding of the demographic situation in Madras State requires an understanding of fertility trends and patterns. Answers have therefore to be found for several questions. What is the actual level of fertility now and what were the levels in the past? How do these levels compare with those of other countries, and above all, what will be the future trends?

These are some questions for which the demographer has to look for evidences from published material and also from fresh enquiries. A commonly used and rather crude measure of fertility is the birth rate which expresses the number of births during a specified period (usually a year) as a ratio of 1,000 of the population at the middle of the period. Crude birth rate is widely used as a measure of fertility since data for computing more refined measures are hardly available and secondly the accuracy of this measure can be easily tested by subjecting the data to certain internal and external consistency checks.

In the present study, an attempt has been made to arrive at the estimates of the birth rate for the decades 1921–31, 1931–41, 1941–51 and 1951–61 and to compare these estimates with those obtained by other methods.

2. Data available for the Study

Unfortunately, despite its central importance, the actual birth rate is unknown, because the system of registration is grossly deficient. There are, however, two lines of statistical evidence that throw some light on trends in fertility. These are (1) the registered births, which though defective, may nevertheless reveal trends; (2) the estimated births based on the Census age data. Each of these lines of evidence is open to criticism, and each one, if it stood alone, or disagreed with others, would be of little value. Yet, since these statistics can be used for certain purposes, it does not pay to dismiss them entirely. It is, however, useful to understand their strengths and weaknesses and make the best use of the available material. Although Indian vital statistics for the country as a whole are rudimentary, yet certain areas enjoying better facilities produce data of a more refined type. Madras State belongs to the category of areas where the registration is fairly good.[2]

Registration of births and deaths in Madras has a fairly long tradition dating back to 1865 when the Madras Births and Deaths Registration Act came into force. This Act was, in the first instance, implemented in a few areas and thereafter extended to more and more villages. Even where the Act was not in force, the registration of births and deaths was carried out on executive instructions of the Collectors. For the purpose of our study we may take the entire State as the registration area.

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[1] Thompson, Warren, S.: Population Problems (1953), p. 237.

[2] Asok Mitra: Introductory note to the Vital Statistics of India for 1959.

Even though an area may be under-registered, this does not mean that the reporting of births is complete. In fact, a recent study conducted at the Demographic Training and Research Centre, Bombay, shows a deficiency of the order of 10% in the registered births. The reason for such a deficiency can be understood if we visualise the rural, illiterate character of the masses and the village Karnam who serves as the Registrar. But whatever be the reasons for such deficiencies in registration, this is a great handicap in the way of using the official returns. The figures for one district cannot be compared with those of another, because the efficiency of birth registration varies significantly from place to place. Nowhere can one accept the official figures as representative of the total number of births, though this error is frequently made in published works in India.

If this is the case with registration data, the position is only slightly better in the case of Census age data which suffers from gross misreporting of age. Fortunately, one could notice certain uniform tendencies in the age reporting that the data could be subjected to certain smoothing processes to make them useful. Broadly, the common tendencies are (1) the preferences shown for ages ending in certain digits *viz.*, zero and five and to a lesser extent for two and eight; (2) the under-enumeration in the young ages *viz.*, 0–10; and (3) exaggeration of years at the older ages. An understanding of these preferences has enabled demographers to arrive at suitable graduating formulae for smoothing the age data. In fact, the Census age data provide useful material for arriving at an independent estimate of the births and birth rates for Madras State.

It will be of relevance to mention here the limitations of data arising from the changes in the boundaries of the State which necessitated very painstaking adjustment of the data for the present Madras State. During the last decade, Madras State has been reduced to nearly half its original size with the separation of Andhra State in 1953 and the reorganisation of States in 1956. The adjustment of data presented several problems and what has been attempted in this study is based on the age distribution for Madras State obtained on a *pro rata* basis.

3. Methodology of the Study

There are two major components in the estimation of the birth rate *viz.*, the births and the population at the middle of the period for which the rate is worked out. As mentioned earlier the registered births suffer from gross under-registration, whereas the total count of the population, though, to a certain extent an under-estimate, may not seriously affect the birth rate. Hence our major concern is about getting a good estimate of the births during any specified period.

One way to estimate births in India is to compare the Census returns with the registered births. Each single year age group can be traced back, on the basis of the deaths registered by age, to the births that must have occurred to give rise to the Census figures. The estimated births can then be matched with the registered births to give a picture of the extent of under-registration. This procedure, however, suffers from certain serious limitations. In the first place, children are likely to be under-estimated in the Census, which can be partially remedied by smoothing. Secondly, births as well as deaths are under-registered. When we use the registered deaths which are incomplete to obtain the estimate of births, this estimate will be below the mark. One way of overcoming this difficulty, at least partially, is to make successive approximations. After a first estimate of births has been made, it can be assumed that deaths are equally under-registered. The deaths can be increased accordingly and a new estimate of births prepared.

The process can be repeated further where necessary.[1]

A more refined method will be to use the life table for tracing the Census cohorts to births[2]. Starting with the children 0–4 and 5–9 in the Census, one gets the total estimated births in the two quinquennia preceding the Census. Comparing these with the births registered during these periods, one gets some notion of the average under-registration. Since the enumeration of different childhood cohorts in the Census has been unequal, it is not proper to estimate births for any particular year by this method. But the average decennial under-registration can be adopted for correcting the registered births for each particular year and thus the corrected birth rates will fluctuate as much as the registered rates. The estimate of births by this method will be independent of other estimates based on vital statistics, since the Indian Life Tables have been constructed without recourse to vital statistics.

Theoretically, it is possible to make an accurate estimate of the birth rate if the age distribution and the appro-

[1] Using this method, Kingsley Davis has obtained a birth rate of 38.71 for 1926–30 for Madras State—Vide Kingsley Davis: Population of India and Pakistan, (page 244).

[2] This method commonly known as the reverse survival method has been adopted by S. P. Jain for working out birth rate for 1941–51. But there are differences in detail between the procedure followed by him and the one adopted in the present study—Vide S. P. Jain's 'Estimation of Birth and Death Rates,' 1941–50, Census of India, Paper No. 6, 1954.

priate life table are available. In practice, this method is subject to several limitations. The inaccuracies in the Census age returns necessitate adjustments in the age data and while using this method for a State like Madras one has also to account for migration from other States. No such corrections have, however, been made and it has been assumed that the age distribution of the migrants will be the same as that of the enumerated population. Moreover, Madras State has undergone vast territorial changes during the last few years and it is assumed that the life tables for the composite Madras State will hold good for the present Madras State.

Since the age group 0–4 is subject to omissions and misreporting, it is preferable to take the age group 5–9 which is considered to be universally well enumerated. However, two estimates which have been attempted here are based on the 0–4 age group and the other on the 5–9 age group. If we further assume that the birth rate would not have changed during each decade, a comparison of these two estimates gives a picture of the under-enumeration in the 0–4 age group in the Census.

If we denote the number of births that occurred in the 'x'th year preceding the Census date by B_x and their survivors to the Census date by N_x [N_x= the number enumerated in the age groups (x, x+1) in the Census] then,

$$B_x \frac{L_{x-1}}{l_0} = N_{x-1}$$

where L_x is the life table population in the age group (x, x+1) corresponding to the initial cohort of l_0. Thus, we have

$$\sum_{x=1}^{4} B_x \frac{L_{x-1}}{l_0} = \sum_{x=1}^{4} N_{x-1}$$

For practical purposes, this is approximately

$$\frac{1}{5\, l_0} \sum_{x=1}^{4} B_x \sum_{x=1}^{4} L_{x-1} = \sum_{x=1}^{4} N_{z-1}$$

$$\text{or} \qquad \sum_{x=1}^{4} B_x = \frac{5\, l_0}{\sum_{x=1}^{4} L_{x-1}} \sum_{x=1}^{4} N_{x-1}$$

The total births during the quinquennium preceding the Census is thus arrived at, which when divided by the mean population of the quinquennium gives the birth rate for the quinquennium. Likewise the number of births 5 to 9 years before the Census is obtained by

$$\sum_{x=5}^{9} B_x = \frac{5\, l_0}{\sum_{x=1}^{4} L'_{x-1}} \cdot \frac{\sum_{x=1}^{4} L_{x-1}}{\sum_{x=5}^{9} L_{x-1}} \sum_{x=5}^{9} N_{x-1}$$

where L'_x is the life table population in age (x, x+1) corresponding to the earlier quinquennium.

In practice, there were several difficulties in the application of this method. The Official Indian Life Tables relate to decennial periods between two Censuses. Moreover no official life tables were constructed for 1911–21 and 1931–41 decades due to the special circumstances prevailing at the time. The 1911–21 decade was marked by a widespread influenza epidemic in many parts of India including Madras State[1] whereas the 1931–41 decade witnessed the outbreak of the Second World War. Luckily, for both the decades, Kingsley Davis has worked out life tables for India[2] and these are useful to draw upon to make assumptions regarding mortality levels in Madras State. The following steps are important in our calculations.

(1) The provincial life tables were adopted for the decades 1901–11, 1921–31 and 1941–51 for the middle of the decades *viz.*, 1906, 1926 and 1946.

(2) The All-India Life Tables of Kingsley Davis was adopted for the decade 1911–21 centered on 1916. Further, it was assumed that the expectancy in the quinquennium 1911–16 had remained at the level of the 1901–11 life tables, and in 1916–21 it had remained at the level estimated for all India by Kingsley Davis.

(3) The life table survival ratios for children aged 0–4 and 5–9 for the intervening quinquennium are obtained by linear interpolation and the estimated survival ratio along with those obtained from the assumed life tables are presented in Table I.

(4) Since the estimates of mid-year population based on the Census counts will suffer from under-estimation, it was decided to adopt the method of the sex-age adjusted birth rate evolved by the U.N.[3]. The 'sex-age adjusted birth rate' is defined as the number of births per 1,000 of a weighted aggregate of numbers of women in the various five-year age groups from 15 to 44.

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[1] A recent study has shown that the number of deaths due to influenza in Madras State in 1911–21 may be of the order of one million or about 5% of the total deaths in the whole of India—vide K. E. Vaidyanathan: "A Demographic Study of Madras State,"—unpublished dissertation submitted at the Demographic Training and Research Centre, Bombay, (Page 70.)

[2] Kingsley Davis: Population of India and Pakistan, Princeton, 1951, (page 238.)

[3] Vide U. N. Manual III: Methods of Population Projections by Sex and Age, (page 42.)

TABLE I

Estimates of Survival Ratios for Children in Madras State, 1911-16 to 1956-61

Details	1901–11	1911–16	1911–21	1916–21	1921–26	1921–31	1926–31	1931–36
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MALES								
Expectancy of life at birth (e_0^0) ...	25.92	25.92	19.42	19.42	24.07	28.71	29.66	31.56
Survival ratio at birth (P_b) ...	0.663050	0.663050	0.614940	0.614940	0.663910	0.712880	0.722315	0.741185
Survival ratio for children of the age group 0-4 (P_{0-4}).	0.824270	0.824270	0.795520	0.795520	0.819335	0.843150	0.849575	0.862425

TABLE I—(*Contd.*)

Estimates of Survival Ratios for Children in Madras State, 1911-16 to 1956-61—(*Contd.*)

Details	1931–41	1936–41	1941–46	1941–51	1946–51	1951–56	1951–61	1956–61
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
MALES– (*Contd.*)								
Expectancy of life at birth (e_0^0) ...	32.51	33.46	35.36	36.22	38.24	42.28	44.31	46.33
Survival ratio at birth (P_b) ...	0.750620	0.760055	0.778925	0.788360	0.803860	0.834860	0.864410	0.893960
Survival ratio for children of the age group 0-4 (P_{0-4})	0.868850	0.875275	0.888125	0.894550	0.896510	0.900430	0.908475	0.916520

TABLE I—(*Contd.*)

Estimates of Survival Ratios for Children in Madras State, 1911-16 to 1956-61—(*Contd.*)

Details	1901–11	1911–16	1911–21	1916–21	1921–26	1921–31	1926–31	1931–36
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
				FEMALES				
Expectancy of life at birth (e_0°) ...	27.65	27.65	20.91	20.91	25.48	30.04	30.94	32.74
Survival ratio at birth (P_b) ...	0.691780	0.691780	0.646910	0.646910	0.693835	0.740760	0.747720	0.761640
Survival ratio for children of the age group 0-4 (P_{0-4})	0.851710	0.851710	0.823830	0.823830	0.849130	0.874430	0.876045	0.879275

TABLE I—(*Contd.*)

Estimates of Survival Ratios for Children in Madras State, 1911-16 to 1956-61—(*Contd.*)

Details	1931–41	1936–41	1941–46	1941–51	1946–51	1951–56	1951–61	1956–61
	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
				FEMALES—(*Contd.*)				
Expectancy of life at birth (e_0°) ...	33.64	34.54	36.34	37.23	39.15	42.98	44.91	46.83
Survival ratio at birth (P_b) ...	0.768600	0.775560	0.789480	0.796440	0.813270	0.846940	0.856725	0.866510
Survival ratio for children of the age group 0-4 (P_{0-4})	0.880890	0.882505	0.885735	0.887350	0.889380	0.893460	0.902440	0.911420

A standard set of weights is used in computing this aggregate, the weights being roughly proportional to the typical relative fertility rates of the various age groups, as determined by examination of the available statistics of births by age of mother for various countries. Since it was considered convenient that these synthetic rates should be of the same order of magnitude as crude birth rates per 1,000 of the total population, the weights were so chosen, not only that they would be roughly proportionate to the averages of the age specific birth rates, but also that the sum of their products with the corresponding numbers of women in the various age groups would ordinarily be of the same order of magnitude as the total population.

(5) The Life Table survival ratios for 1951–56 and 1956–61 were adopted from the estimate made at the Demographic Training and Research Centre Bombay.[1]

(6) The number of women in the reproductive age groups for working out the age-sex adjusted birth rate was obtained by smoothing the census age-sex distribution. Further, the number of women at the middle of the intervening quinquennium was arrived by linear interpolation of the terminal census data (vide Table II).

[1] Vaidyanathan, K. E.: Population Projections for Madras State, 1961–81 (mimeographed).

TABLE II

Estimates of women in reproductive age groups, 1911 to 1961

Age Group		1911	1913.5	1916	1918.5	1921	1923.5	1926
15—19	...	980,294	980,242	980,190	980,138	980,086	999,807	1,019,528
20—24	...	948,692	952,710	956,728	960,746	964,765	1,016,878	1,068,992
25—29	...	910,043	926,999	943,956	960,912	977,869	996,441	1,015,013
30—34	...	794,754	813,666	832,579	851,492	870,404	888,837	907,271
35—39	...	679,436	688,454	697,472	706,490	715,508	723,825	732,142
40—44	...	601,273	602,027	602,781	603,535	604,290	612,888	621,486

Age Group		1928.5	1931	1933.5	1936	1938.5	1941	1943.5
15—19	...	1,039,248	1,058,969	1,117,243	1,175,518	1,233,792	1,292,066	1,340,656
20—24	...	1,121,105	1,173,218	1,182,189	1,191,160	1,200,131	1,209,101	1,239,942
25—29	...	1,033,585	1,052,157	1,071,397	1,090,638	1,109,878	1,129,118	1,161,978
30—34	...	925,704	944,138	955,455	966,772	978,089	989,405	1,023,999
35—39	...	740,459	748,777	772,335	795,893	819,451	843,009	877,066
40—44	...	630,084	638,683	657,355	676,027	694,699	713,371	749,600

Age Group		1946	1948.5	1951	1953.5	1956	1958.5	1961
15—19	...	1,389,246	1,437,836	1,486,426	1,503,514	1,520,603	1,537,691	1,554,779
20—24	...	1,270,783	1,301,624	1,332,465	1,377,030	1,421,596	1,466,162	1,510,728
25—29	...	1,194,839	1,227,699	1,260,560	1,308,232	1,355,905	1,403,577	1,451,249
30—34	...	1,058,593	1,093,187	1,127,782	1,159,331	1,190,881	1,222,430	1,253,979
35—39	...	911,123	945,180	979,237	1,000,624	1,022,010	1,043,396	1,064,783
40—44	...	785,829	822,058	858,287	870,265	882,243	894,221	906,199

4. Results of the Study

The number of births corresponding to the two cohorts 0–4 and 5–9 enumerated in the 1921, 1931, 1941, 1951 and 1961 Censuses has been estimated as described in section 3 above. The results are set out in Table III. It may be seen from this table that the estimates based on the cohort 5–9 are higher than the estimates based on the cohort 0–4. This conforms to the universal experience that 5–9 age group is better enumerated than the 0–4 age group. Further, the estimate based on the 0–4 cohort reveals an excess of males over females except for 1931 and 1961. Biologically, one should expect an excess of males over females at birth and hence this female excess in 1931 and 1961 could be due to selective omission of male children aged 0–4 in the 1931 and 1961 Censuses. We also find a female excess at birth in respect of the cohort aged 5–9 in the 1951 Census. This could perhaps be due to a selective omission of male children aged 5–9 in the 1951 Census. This distortion in the sex ratio of the estimates could also be due to age heaping. It is, however, not worthwhile to attempt a further improvement in these estimates of births, nor is it easy under the present circumstances.

TABLE III

Estimates of number of births in Madras State by "Reverse Survival" of two Cohorts of Children enumerated in 1921, 1931, 1941, 1951 and 1961

Cohort of children	1921		1931		1941		1951		1961	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
A. Cohort aged 0–4										
1. Survivors enumerated in ...	1,344,972	1,405,676	1,675,093	1,735,354	1,770,375	1,787,385	1,805,504	1,815,389	2,310,340	2,299,429
2. Estimated Survival Ratio in quinquennium ended ...	0.614,940	0.646910	0.722315	0.747720	0.760055	0.775560	0.803860	0.813270	0.893960	0.866510
3. Estimated births in quinquennium ended ...	2,187,160	2,172,908	2,319,062	2,320,861	2,329,272	2,304,637	2,246,043	2,232,209	2,584,389	2,653,667
B. Cohort aged 5–9										
1. Survivors enumerated in ...	1,419,270	1,469,595	1,507,079	1,491,625	1,771,198	1,803,834	1,772,838	1,803,944	2,160,180	2,147,104
2. Estimated Survival Ratio in quinquennium ended ...	0.795520	0.823830	0.849575	0.876045	0.875275	0.882505	0.896510	0.889390	0.916520	0.911420
3. Estimated Survival Ratio in preceding quinquennium ...	0.663050	0.691780	0.663910	0.693835	0.741185	0.761640	0.778925	0.789480	0.834860	0.846940
4. Estimated births in preceding quinquennium ...	2,690,712	2,578,649	2,671,932	2,454,013	2,730,208	2,683,674	2,538,740	2,569,150	2,823,152	2,781,518

The age-sex adjusted birth rates for different quinquennia are presented in Table IV.

TABLE IV

Estimates of Age-Sex adjusted birth rates for 1911-16 to 1956-61

Details	1911-16	1916-21	1921-26	1926-31	1931-36
(1) Estimated annual births ...	1,053,872	872,014	1,025,189	927,985	1,082,776
(2) Weighted sum of females in reproductive ages ...	22,376,044	22,970,191	23,934,250	25,268,222	26,371,770
(3) Age-sex adjusted Birth Rates ...	47.1	38.0	42.8	36.7	41.1

Details	1936-41	1941-46	1946-51	1951-56	1956-61
(1) Estimated annual births ...	926,731	1,021,578	895,650	1,120,934	1,047,611
(2) Weighted sum of females in reproductive ages ...	27,244,892	28,555,954	30,304,997	32,129,095	34,028,249
(3) Age-sex adjusted Birth Rates ...	34.0	35.8	29.6	34.9	30.8

Since there is little evidence to show that the first quinquennium of each decade will be markedly different from the second, the low estimates for the latter must be due to under-enumeration of children in the age group 0-4 in the different Censuses. Table V shows the extent of under-enumeration in 0-4 age group in the different Censuses thus arrived at.

TABLE V

Estimated birth rates and the percentage of under-count in 0-4 age group

Year		First Estimate	Second Estimate	Percentage of under count 0-4 age group
(1)		(2)	(3)	(4)
1921	...	47.1	38.0	19.3
1931	...	42.8	36.7	14.3
1941	...	41.1	34.0	17.3
1951	...	35.8	29.6	17.3
1961	...	34.9	30.8	11.7

It is seen that the under-enumeration in 0-4 age group has been highest in the 1921 Census (19.3%) and since fluctuated between an improvement in 1931 and a deterioration in 1941 and finally there was a remarkable improvement in the 1961 Census with the lowest ever recorded under-count of 11.7%. Column (2) reveals a decline in the birth rate during the last forty years. This decline is marked in the period 1921-31 and 1941-51. During the last decade, there has been only a slight fall in the birth rate. The figures in column (3) actually show a rise in the birth rate. The reason for this will be evident if we see column (4) which shows an improvement in enumeration of ages 0-4 in the 1961 Census. If a similar improvement has happened in the ages 5-9 also, this could have the effect of inflating the birth rate obtained by retracing the 5-9 age cohort and the decline in birth rate during 1951-61 appears to be less. In other words, the decline in birth rate could be more than what is apparent from column (2).

It is interesting to compare these figures with the earlier estimates for the composite Madras State arrived at by Kingsley Davis (1921-30)[1] and S. P. Jain (1941-50)[2].

[1] Kingsley Davis: Population of India & Pakistan, Princeton, 1951, (page 244.)

[2] S. P. Jain, Estimation of Birth and Death Rates in India during 1941-50, 1951 Census. Census of India, Paper No. 6, 1954, (page 37.)

TABLE VI

Comparison of the present estimates with earlier estimates of birth rate for Madras State

Period		Our estimates	Earlier estimates
1921—30	...	42.8	41.93 (Kingsley Davis)
1941—50	...	35.8	34.70 (S. P. Jain)

The estimates of Kingsley Davis and S. P. Jain are based on a slightly different variant of the reverse survival method where they have traced the entire 0–9 age cohort instead of the 5–9 age cohort. The remarkable agreement between our estimates with those obtained earlier, further confirms that the entire composite Madras State could be regarded as one geographical zone for the purpose of studies on fertility.

Further, it is useful to compare the estimates obtained in the present study with those worked out from registration data to obtain a picture of the degree of under-registration in the various decades. Such a comparison is attempted in Table VII below.

TABLE VII

Comparison of the present estimates with registered birth rates[1]

Period			Average annual registered births	Estimated mid-decennial population	Registered birth rate	Estimates obtained in the present study	Percentage of under-registration
(1)			(2)	(3)	(4)	(5)	(6)
1921-30	...	...	669,764	22,012,324	30.4	42.8	29.0
1931-40	...	...	810,586	24,240,392	33.4	41.1	18.7
1941-50	...	...	822,921	27,441,602	30.0	35.8	16.2
1951-60	...	...	846,683	30,991,501	27.3	34.9	21.8

[1] The births, mid-year population and registered birth rates relate to Madras State exclusive of Kanyakumari district.

This table shows that after a gradual improvement in efficiency of birth registration in 1921–51, there has been a deterioration of birth registration during the decade 1951–61. If the figures in column (6) of Table VII reflect anything, they reflect only the apathy of the Registrars of Births towards official efforts for improving registration. If one can hazard a guess, the reason for this apathy towards registration task could well be due to the increasing role in other spheres which has assumed importance in the wake of our developmental effort.

The above analysis leads one to ponder whether the moderate decline in fertility in Madras State is indicative of a more spectacular reduction in future. The shift from high mortality and high fertility to moderate mortality and moderate fertility which has taken place in many countries in association with the development of scientific and mechanical technology is frequently referred to as "demographic transition". This term only indicates a general tendency; and unless properly understood even conveys a false impression by its over-simplification. There is no parallel between movements of mortality and movements of fertility, except that a decline in mortality creates conditions favourable to a decline in fertility. In the United States, the decline of crude birth rate began to exceed the decline in crude death rate more than a hundred years ago, as shown by a continuing decline in the rate of natural increase from 1800–20 to the 1930s. In France, the declines of fertility and mortality ran a parallel course during the nineteenth century and the earlier decades of the twentieth century. In most European countries, the decline in fertility lagged far behind the decline in mortality. In some Asiatic and Latin American countries there have been

large declines in mortality with no indication to date of any general decline in fertility.[1]

An examination of ways in which cultural conditions influence trends in fertility in relation to economic and social development in non-industrial societies is a subject of critical importance. Yet, it is here that these countries suffer from inadequacy of data and to a certain extent we are fortunate that we have some data to conduct such analysis.

Broadly speaking, control of fertility could happen in either of two ways (1) tendency towards postponement of marriage, (2) control of fertility within marriage. According to a recent study, the mean age at marriage has been steadily rising and this could contribute to a sizable reduction of fertility.[2] There was apparently little change in the social set-up in the past and hence the decline in fertility in the past could be largely explained by the rise in age at marriage to a certain extent offset by the reduction in widowhood consequent on reduction in mortality. However, a stage will be reached when a further rise in the age at marriage is unattainable and the reasons for a future decline in fertility have to be found in control of fertility after marriage.

At the moment, changes in social set-up and especially those governing conjugal relations are hardly visible. The practice of contraception is at best limited to educated classes and there is little evidence to show that it is catching up among the lower classes. It will take some more time before one can discern far-reaching changes in the social institutions having a bearing on fertility. The data thrown up by the 1961 Census on the several aspects of the subject may reveal the effect of a multiplicity of social, economic and personal factors on the reproductive behaviour of Madrasis.

[1] Frank Lorimer: Culture and Human Fertility, UNESCO, pages 205–6.

[2] Agarwala, S. N., " Mean age at marriage in India 1901–51 " Princeton (Unpublished).

APPENDIX XVI

A STUDY OF MATERNITY DATA OF SELECTED HOSPITALS IN MADRAS STATE

Object of the study

In 1959, Shri Asok Mitra, Registrar-General, suggested that the information collected through vital registration on the sex ratio at birth should be corroborated by other independent evidences. He suggested that ten large hospitals where the registration in the maternity wards is made efficiently and meticulously should be selected and information on the following aspects should be collected:

(1) Community: whether Hindu, Muslim or Christian

(2) Occupation of husband and average monthly salary

(3) Age of woman confined

(4) Whether this is the first confinement of the woman

(5) Whether child born was still or alive

(6) Sex of child born

(7) Sex of first child, if confined in hospital and whether first child born was live or still

The object of the study as enunciated by Shri Mitra is to supplement the available vital statistics with useful information based on hospital data which should also incidentally record the progressive increase in the number of cases of confinement year by year since 1951 when the Bhore Committee's recommendations began to be implemented.

Usually, hospital records furnish information about (*a*) the sex of the child born, its birth order and whether live birth, still birth or multiple birth, (*b*) the age of the mother, and (*c*) the religion, occupation and income of the parents. As the population from which these cases come is not known, it is not possible to work out the birth or fertility rates. Absolute figures by themselves do not have much meaning. Analysis of the data has therefore to be based on some sort of averages. Maternity cases coming to the hospitals may be very select and are likely to be confined to a narrow band of mother's age, birth order, income and occupation. Variations may be observed mainly due to changes in these factors and it may not always be possible to ascribe them to intrinsic variations in the fertility pattern.

These limitations and also the availability of data were kept in view while the proforma was designed. Information regarding item 7 suggested by Shri Mitra was not available from the hospital record and so this item could not be incorporated in the proforma devised by us. On the other hand a question on the weight of the child was included. As a preliminary, information was collected in respect of the Women and Children Hospital, Egmore, for the year 1950, and the experience gained was useful in designing a suitable proforma. The format of the proforma used is presented below:

Proforma for the collection of maternity data

Hospital:	Year:
Ward:	No:
Name:	
Age in completed years	No. of pregnancy:
Date of admission:	
Religion:	Complex or not:
Occupation { Details: / Code:	
Salary:	Weight of child at birth
Result of child at birth:	Sex:

Three hospitals in the City of Madras, *viz.*, the Women and Children Hospital, Egmore, Kasturba Gandhi Hospital, Triplicane, R.S.R.M. Hospital, Royapuram, two hospitals in Coimbatore and two hospitals in Madurai were selected for the study. The staff deputed from this Office examined the records relating to these hospitals from 1950 to 1959 and entered the relevant information in the slips printed and supplied to them. There were about three lakhs cases which were analysed and tabulated.

Results of the study

The total number of cases recorded in the hospitals were classified with reference to the result of the birth *viz.*, live births, still births and abortions. This result of the birth was also related to gravida (order of pregnancy) so as to find out the pattern of result of birth for each gravida. The results are indicated in Table I.

TABLE I

Type of Birth by Gravida for selected Hospitals, 1950–59

Gravida	...	Live births	Abortions	Still births	Total cases	Percentage to total births in each gravida		
						Live births	Abortions	Still births
1	...	64,668	8,741	3,362	76,771	84.2	11.4	4.4
2	...	48,447	7,448	1,697	57,592	84.2	12.9	2.9
3	...	41,244	6,727	1,484	49,455	83.4	13.6	3.0
4	...	32,129	5,784	1,238	39,151	82.1	14.8	3.1
5	...	25,205	4,605	1,080	30,890	81.6	14.9	3.5
6	...	17,957	3,426	843	22,226	80.8	15.4	3.8
7	...	12,738	2,575	753	16,066	79.3	16.0	4.7
8	...	7,650	1,551	503	9,704	78.9	15.9	5.2
9	...	4,928	992	343	6,263	78.7	15.8	5.5
10	...	4,896	1,378	401	6,675	73.4	20.6	6.0
Total	...	259,862	43,227	11,704	314,793	82.6	13.7	3.7

It is observed that on an average, about 82.6% of the births result in live births leading to a maternal wastage of 17.4%, consisting of 13.7% of abortions and 3.7% of still births. On perusing the pattern of change over different gravida, it is seen that the percentage of live births decreases gradually as the order of pregnancy increases. The percentage of still births records a slow and small increase as the gravida increases, but the variation in percentage of abortion does not exhibit any definite and smooth trend. However, it may be interesting to notice that the percentage of abortions recorded in a study of births in U.S.A., (as indicated in "Population problems" by Warren S. Thompson—McGraw Hill Book & Co., 1953) varies from 12.1% to 16.8% or 18 abortions per 100 live and still births. It is not known how many of the abortions are spontaneous and are preventable, nor is it known how many of the therapeutic abortions prevented a normal live birth. But, there can be no reasonable doubt that the number of live births would be significantly larger if all preventable spontaneous abortions were eliminated and if there were no illegal abortions.

The live births have been classified by the month at which they have occurred and is shown in Table II. The highest percentage of births occur in October and the last quarter (October—December) records 26.5% of the total births, the first quarter recording only 22.3%.

A statistical analysis was made to find out whether the pattern reveals any relationship between month and number of births. The Chi Square test applied to the 1956 hospital data reveals that there is statistically significant relationship between the two. The number of births to a considerable extent varies according to month and a certain degree of seasonality is revealed by the data. A similar test was conducted to find out whether the seasonality differs for first gravida compared to other gravida but no such difference was revealed by the test.

TABLE II

Births (Including Multiple Births) in selected Hospitals by Months, 1950-59

Months		Hospital								
		Egmore I	Triplicane II	R.S.R.M. III	IV	V	VI	VII	Total	Percentage of Births
January	...	9,144	5,698	4,317	2,745	1,124	2,036	628	25,692	7.9
February	...	7,589	4,564	3,830	2,379	1,022	1,625	521	21,530	6.6
March	...	9,017	5,653	4,413	2,822	1,188	1,880	634	25,607	7.8
April	...	9,268	5,838	4,342	3,073	1,084	1,983	639	26,227	8.0
May	...	10,129	6,168	4,927	3,068	1,134	2,033	753	28,212	8.6
June	...	10,013	6,032	4,762	3,042	1,127	1,621	754	27,351	8.4
July	...	10,490	6,275	5,172	3,249	1,117	1,617	716	28,636	8.8
August	...	10,862	6,602	5,409	2,888	1,191	1,550	654	29,156	8.9
September	...	10,698	6,392	5,115	2,428	1,093	1,502	662	27,890	8.5
October	...	11,141	6,736	5,413	2,612	1,225	1,678	735	29,540	9.1
November	...	10,613	6,442	5,202	2,872	1,258	1,721	662	28,770	8.8
December	...	10,094	6,292	5,129	2,821	1,245	1,668	646	27,895	8.6
Total	...	119,058	72,692	58,031	33,999	13,808	20,914	8,004	326,506	100.0

The sex ratio (females per 100 males) at birth classified by gravida is presented in Table III.

TABLE III

Sex Ratios at birth by Gravida

Gravida			Males	Females	Ratio
1	...	...	33,663	30,930	91.89
2	...	...	25,032	23,369	93.35
3	...	...	21,268	19,946	93.83
4	...	...	16,600	15,497	93.30
5	...	...	12,963	12,216	94.19
6	...	...	9,273	8,671	93.53
7	...	...	6,538	6,188	94.64
8	...	...	4,020	3,623	90.14
9	...	...	2,499	2,425	97.03
10	...	...	2,448	2,442	99.77
Total			134,304	125,307	93.28

The sex ratio is always less than 100 indicating more male births than female births, but no significant and systematic variation is revealed for the various gravida. The sex ratio at birth has also been classified by religion and the results are shown in Table IV.

TABLE IV

Sex Ratio at birth by Religion

Hospital		Hindus	Christians	Muslims
I	...	93	93	87
II	...	95	88	91
III	...	92	91	94
IV	...	93	100	94
V	...	96	88	73
VI	...	93	99	86
VII	...	95	101	105

Male majority is observed to be higher in first births than among other births with the exception of eighth gravida where male excess is much higher than in first, though of course the total number of cases in first gravida is ten times that of eighth gravida.

A similar trend (higher male majority) has been recorded by Bernardo Colombo as published in an article on the " Sex ratio in Man " in population studies (Cold Spring Harbor Symposia on quantitative Biology, Vol. XXII, New York). " Male majority is normally higher in first births than in those of subsequent orders both among live and total births. A regular downward trend of male proportion in live births with increasing parity seems evident at least in the lowest orders."

The sex ratio at births has also been examined with reference to the month at which the births have occurred. Bernardo Colombo has also discussed this aspect and has concluded that according to his analysis male majority is at a minimum during autumn. Male predominance is noticed during June through August.

The 1956 data of Egmore hospital was also tabulated by month and is indicated in Table V which reveals a sudden female preponderance in June which is a very marked deviation from that of the previous month. However, male predominance is at a maximum in August (where sex ratio is 82.3).

TABLE V

Sex ratio at birth computed from data in respect of Egmore Hospital, 1956

Months		Males	Females	Sex Ratio*
January	...	444	393	88.5
February	...	374	361	96.5
March	...	461	405	87.9
April	...	419	413	98.6
May	...	508	433	85.2
June	...	422	432	102.4
July	...	472	462	97.7
August	...	491	404	82.3
September	...	409	397	97.1
October	...	490	427	87.2
November	...	485	413	85.2
December	...	454	407	89.7
Total	...	5,430	4,947	91.1

* Females per 100 males.

The average age for each gravida has been calculated and has been classified by religion. It is noticed (Table VI) that the average age for first gravida is 20.5 for Hindus, 21.45 for Christians and 20.65 for Muslims. The average age for first gravida as furnished in Birth Order Statistics for India by Sri S. P. Jain on the basis of the data relating to 1946–48 is slightly higher *viz.*, 21.9. Except for the first birth, the average age for all other gravida is less for Muslims than for Hindus or Christians.

TABLE VI

Average age for each gravida (All Hospitals)

Gravida		Hindus	Christians	Muslims
1	...	20.5	21.4	20.7
2	...	22.5	23.2	22.3
3	...	24.7	25.0	24.2
4	...	26.5	26.5	25.7
5	...	27.9	28.1	27.2
6	...	29.4	29.8	28.5
7	...	31.1	31.3	30.3
8	...	32.4	32.7	31.5
9	...	33.5	33.9	32.0
10 & over	...	35.1	35.6	34.3
All Gravida	...	24.9	25.5	24.7

The average age for first birth has been calculated for each year from 1950–59 with reference to cases recorded in Madras Egmore Hospital, Triplicane, and R.S.R.M. The results are shown in Table VII.

TABLE VII

Average age for first birth

Year		Egmore hospital	Triplicane hospital	R.S.R.M. Hospital	Hospital IV
1950	...	20.45	...	21.0	20.43
1951	...	20.40	...	20.5	20.1
1952	...	20.70	...	20.5	20.46
1953	...	20.43	20.6	20.31	20.55
1954	...	20.44	20.4	20.35	20.50
1955	...	20.32	20.3	20.34	20.37
1956	...	20.35	20.3	19.85	20.45
1957	...	20.24	20.36	19.92	20.55
1958	...	20.27	20.4	19.85	20.5
1959	...	20.29	20.55	...	20.30

Though there is no uniform decrease over the 10 years, there is a significant fall in average age for first birth from 20.45 in 1950 to 20.29 in 1959. Similarly, in Triplicane hospital the fall is from 20.6 in 1953 to 20.5 (not very significant) and from 21.0 to 19.85 in R.S.R.M. Hospital.

Another interesting conclusion that can be derived from Table VI is that the average age to each gravida is very much less for Hindus compared to All India figures furnished by Sri Jain. No doubt there should be a difference in average age between the present analysis and that of Sri S. P. Jain because of the varying definition of the concepts used *i.e.*, the gravida (number of pregnancies) is taken as the basis in this study whereas order of birth (*i.e.*, live births) is adopted in Sri S. P. Jain's analysis.

The latter study excludes abortions and still births and therefore for effective comparison at every gravida, the abortions and still births have to be eliminated so that a person with third gravida might be having the first live birth only in which case the average age will increase. Another interesting result of the study of maternity data of selected hospitals is the information on the weight of the child at birth. The average weight of the child at birth in each of the hospitals in the years 1950 to 1959 are presented in Table VIII. No uniform trend is noticeable over the years, but in all the hospitals we find that the male baby weighs more than the female baby. Since at the time of birth, the mothers should have had the same type of pre-natal care irrespective of the sex of the child to be born, it appears likely that the difference in the weight of the babies of either sex must be attributable to biological rather than environmental factors.

TABLE VIII

Average weight in seven hospitals in each year from 1950 to 1959

(*in lbs.*)

Year	Hospital I		II		III		IV		V		VI		VII	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
1950	6.29	6.19	...	...	6.54	6.30	7.34	7.12	6.16	6.02	...	...	6.02	5.81
1951	6.36	6.20	...	...	6.48	6.34	7.69	7.02	6.08	5.97	...	...	6.17	6.10
1952	6.33	6.15	...	...	6.49	6.34	7.27	7.12	6.02	5.91	...	...	6.13	6.09
1953	6.22	6.05	6.72	6.58	6.43	6.22	7.26	6.99	6.08	5.91	...	...	6.36	6.05
1954	6.44	6.28	6.68	6.71	6.44	6.22	6.57	6.43	5.99	5.86	6.96	6.78	6.39	6.03
1955	5.94	5.79	6.55	6.38	6.44	6.27	6.38	6.25	6.02	5.92	...	...	...	...
1956	6.22	6.07	6.29	6.27	6.55	6.35	6.41	6.16	6.18	5.99	6.88	6.72	6.16	5.91
1957	6.16	6.03	6.39	6.24	6.44	6.27	6.42	6.30	6.05	5.87	6.66	6.53	6.45	6.25
1958	6.27	6.15	6.49	5.41	6.61	6.42	6.48	6.30	6.12	6.01	6.42	6.18	6.39	6.23
1959	6.25	6.10	6.47	6.31	...	...	6.43	6.25	6.13	5.95	6.37	6.13	6.36	6.35

Likewise, an attempt has been made to study the influence of gravida on the weight of the child and the average weight has been worked out for different gravida and presented in Table IX. For purposes of comparison the non-complex cases have been separated out and similar indices have been worked out. In all cases we find a gradual increase in the weight of the child with gravida. Thus, while the child of the first gravida weighs only 5.95 lbs., that of the tenth gravida weighs 6.72 lbs. In the non-complex cases the first child weighs only 5.84 lbs., whereas that of the tenth gravida weighs 6.60 lbs.

TABLE IX

Weight by gravida for both sexes for different Hospitals, 1950–59

(in lbs.)

Gravida	All Hospitals	Hospital I	II	III	IV	V	VI	Non-complex VII
1 ...	5.95	5.78	6.05	6.00	6.32	6.23	5.67	5.84
2 ...	6.31	6.14	6.41	6.37	6.71	6.02	6.71	6.16
3 ...	6.43	6.27	6.54	6.50	6.75	6.03	6.62	6.27
4 ...	6.51	6.35	6.60	6.57	6.86	6.14	6.80	6.38
5 ..	6.54	6.37	6.63	6.63	6.83	6.23	6.74	6.28
6 ...	6.59	6.44	6.67	6.67	6.91	6.23	6.82	6.32
7 ...	6.60	6.45	6.72	6.65	6.93	6.27	6.76	6.33
8 ...	6.64	6.50	6.70	6.67	7.07	6.26	6.88	6.33
9 ...	6.67	6.54	6.76	6.73	7.04	6.32	5.82	6.34
10 ...	6.72	6.54	6.77	6.83	7.11	6.24	6.88	6.60

A more interesting result is the analysis of the weight of the child born in relation to income of the parent presented in Table X. We find a steady rise in the average weight with an increase in income of the parent in respect of all the six hospitals studied. For all the hospitals we find that the children born to parents in the income range Rs. 1–49 per mensem weigh only 6.25 lbs., whereas that in the income range Rs. 1,000 and over weigh 7.19 lbs., a difference of 15%.

TABLE X

Average weight by income of parent

Income (Rs. per mensem)	Hospital I	II	III	IV	V	VI	All Hospitals
1—49 ...	6.09	6.37	6.36	6.31	5.90	6.90	6.25
50—99 ...	6.23	6.49	6.45	6.31	6.01	6.55	6.30
100—199 ...	6.41	6.63	6.84	6.59	6.13	6.90	6.52
200—299 ...	6.49	6.81	7.01	6.83	6.34	6.99	6.71
300—499 ...	6.77	6.97	7.25	6.62	6.48	7.26	6.88
500—999 ...	6.89	7.17	7.12	7.02	6.31	6.45	6.99
1,000+ ...	7.31	7.23	...	...	...	7.95	7.19

APPENDIX XVII

DEVELOPMENT OF SANITARY LAW IN THE STATE

Prior to 1884, the legal enactments which contained provisions for the improvement of sanitation, etc., in rural areas and municipal towns were the Madras Act IV of 1871 (the Madras Local Funds Act) and Madras Act III of 1871 (the Town Improvements Act). These Acts contained provisions for the improvement of vaccination in rural areas and municipal towns under which local funds were made available for the purpose of training and employing vaccinators. They also provided for the construction and repair of hospitals, dispensaries and lunatic asylums for the sanitary inspection of towns and villages, the cleansing of roads, streets, tanks, any other local works of public utility calculated to promote the health, comfort and convenience of the people and for the registration of vital statistics.

In 1884, these Acts were superseded. Under Act V of 1884 (Local Boards Act), which came into force on 1st April 1885, the principle of Local Self-Government was freely extended in the Madras Presidency. As far as possible, the constitution of local bodies administering this Act was made to fit into the already existing institutions of the country, which required but little adaptation. From time immemorial, decisions on matters of importance had been made by village committees known as Panchayats. The Panchayat was an institution with which the ordinary villager was thoroughly familiar. He had been accustomed to see solemn and formal trials on questions of caste undertaken and the administration of temple funds effected by similarly constituted committees. To make the already existing Headman the Chairman of the Panchayat, and to give him the necessary aid of a trained secretary and accountant in the person of the Karnam was an easy matter. To group villages according to their importance as regards population was the next step, and this naturally secured the classification into Unions and Major Unions. The duties of these unions were thus defined in the Act.

I. In all unions :

(a) Cleansing the village streets, drains, tanks, wells and other public places, and

(b) Generally doing such things as might be necessary for the preservation of public health.

II. In major unions :

(a) Making and repairing the village streets and drains.

(b) Constructing and repairing such tanks, wells and other works as will supply the inhabitants of the union with a sufficient supply of water for domestic use.

The revenue division of the district into taluks was next utilised, and boards were constituted for the governing of those smaller bodies, which, in their turn, were placed under the control of the District Board, a central body having for its President, the Collector of the district. This form of Government was received with considerable favour, and the position of a member of the District Board or of the minor boards was regarded as one of honour. The result of the extension of organization beyond that provided for in the old Madras Local Funds Act of 1871 was to give a general impetus to the conservancy of villages, a very essential point. Provision was made in the new Act for the supervision of private wells and streams ; but the protection of public water supplies, the prevention of the defilement of rivers by the burial of the dead in river-beds and the like, and the prevention of infectious diseases were matters that could not be attended. Difficulties in enforcing sanitation in villages near which Magistrates were not stationed were evident ; but, on the whole, a distinct advance was made. The new Act, among other objects, provided for the improvement of village sites and water supply, for sanitary arrangements during fairs and festivals, for the scavenging of small towns and large villages, for the construction and repair of markets, slaughter-houses, latrines, dust-bins and drains and other measures calculated to promote the health, comfort and convenience of the people.

The City of Madras had a separate Act of its own, *viz.*, Act I of 1884, which came into force on 1st April 1884 and superseded Act V of 1878 under which the town had previously been administered. Under this new Act, vaccination was made compulsory. Provisions were included for regulation of the conservancy of the town and for the improvement of general sanitation.

As regards the other municipal towns in the Presidency, the "Towns Improvement Act of 1871" was superseded by the Madras District Municipalities Act, 1884 (Act IV of 1884) which came into force on the 1st of April 1884. Under this new Act, Municipal Councils were constituted in 47 towns, to all of which the 1871 Act had applied. The affairs of each municipal town were

looked after by a Municipal Council consisting of not less than 12 members and presided over by a Chairman. A proportion of the members of the Council was in most cases elected by the inhabitants. With few exceptions, Councils elected their own Chairmen, Government only exercising the right of making appointments where such action was called for in the public interest. By 1886, the number of Municipal Councils in the Presidency had increased to 54, and at the present time the number is 81 in all.

Meantime, experience showed that, so far as sanitary measures were concerned, Act V of 1884 (Local Boards Act) was practically devoid of any powers by which public health could be improved. Although District Boards collected funds and spent a certain amount in the cause of sanitation, they could do but little in enforcing precautions against infectious diseases, and as a result, the entire rural population was subject to no sanitary control beyond that which could be effected by "persuasion." A draft bill for the amendment of the Local Boards Act was issued in 1897 for criticism and suggestions, but it was not until 1st October 1901 that this amending Act came into force. It contained a number of advantageous sanitary rulings in such primary matters as protection of water supplies, conservancy and combating of infectious diseases.

Although the District Municipalities Act of 1884 had obvious defects which prevented the enforcement of some of the sections, thereby hindering advance of the sanitary measures to which they referred, no amendment of the Act was taken up for a very long time. At the same time, the powers conferred by the Act might have greatly improved sanitation, if these had been exercised by the municipal authorities. Although a few municipalities showed praiseworthy energy in carrying out the recommendations of inspecting officers, the general attitude in regard to sanitation was one of apathy. Failure to execute schemes for the improvement of sanitation was usually put down to "want of funds," and the recommendations of the inspecting officers were put aside endorsed "to be attended to as funds permitted." The plea of "lack of funds" might have been described more accurately as "lack of interest" in the majority of cases.

Intense legislative activity occurred during the years 1919 and 1920, when all three Acts, *i.e.*, the Local Boards Act, the District Municipalities Act and the City Municipal Act were revised. It was hoped that with the passing of the new District Municipalities Act of 1920 and with the enhanced powers conferred by it, sanitary measures in municipalities would be enforced with greater energy and vigour. Apart from extensive sanitary schemes involving heavy expenditure, which the present financial position has kept in abeyance, municipal councils could do a great deal in matters not beyond their financial resources. These include enforcement of the compulsory provisions relating to vaccination, the registration of vital statistics, the control of epidemic diseases, the licensing of offensive trades and working of the provisions for the general improvement of sanitation. The reports of inspecting officers, in which attention is drawn to easily remedied defects, are, however, only too often pigeon-holed, so that succeeding reports become mere reiterations.

The new Local Boards Act (Act XIV of 1920) came into force on 1st April, 1921. In spite of great advance in the legal obligations under the new Act in matters relating to public health, sanitation in rural areas has not received adequate attention. As a result of the recommendations made by the Decentralization Committee of 1908, the subjects of Public Health and Sanitation were transferred to taluk boards. Experience in local government administration in England and elsewhere has proved the grave disadvantage of small units of Local Self-Government, and the trend in those countries has been, of late, to enlarge them. Moreover, it has been found in practice that with a District Health Officer under the President, District Board, with Health Inspectors distributed one to each taluk, and vaccinators appointed and paid for by the Taluk Boards, effective control by the District Health Officer is very difficult. The dual control in this branch is one of the reasons why greater improvement in vaccination work has not been forthcoming, and so long as this anamalous position continues the District Health Officers will not be able to obtain proper co-ordination of the work in the districts. Moreover, practically every proposal made by the Public Health Department to these small local bodies is met with the reply that no funds are available, or that the Board does not agree with the opinion of the Director of Public Health. If the dual control could be abolished, the District Health Officer could without delay concentrate the whole or part of his district staff in any particular area in an emergency.

The full titles of the chief Acts which contain sections bearing on public health are given below. It is not proposed here to give a survey of the individual sections dealing with public health but only such notes as will make it easy to refer to the Acts themselves :—

(1) The Madras City Municipal Act, 1919

(2) The Madras District Municipalities Act, 1920

(3) The Madras Local Boards Act, 1920

(4) The Madras Village Panchayat Act, 1923

(5) The Madras Town Planning Act, 1920

(6) Madras Town Nuisances Act, 1889, with amending Acts and Regulations

(7) The Indian Factories Act, 1911

(8) Registration of Births and Deaths Act, 1899

(9) The Epidemic Diseases Act, 1897

(10) Madras Prevention of Adulteration (Foods and Drugs) Act, 1918 and amending Act, 1927

(11) Indian Penal Code (Nuisances and Adulteration of Foodstuffs)

(12) Code of Criminal Procedure

(13) Indian Ports (Amendment) Act, 1911

The Provisions of the Madras City Municipal Act and the Madras District Municipalities Act in connection with public health matters are very similar in nature, and will be found in both instances in Part IV which deals with "Public Health, Safety and Convenience."

The chapters in Part IV are as follows :—

Chapter VII	...	Water-supply, lighting and drainage
Chapter VIII	...	Scavenging
Chapter IX	...	Streets, Public and Private and Encroachments
Chapter X	...	Building Regulations
Chapter XI	...	Nuisances
Chapter XII	...	Licenses, fees for various offensive trades, disposal of the dead, etc.
Chapter XIII	...	Vital Statistics and Prevention of Diseases

Part V, Chapter XIV deals with rules, bye-laws and regulations, and Section 349 of the Madras City Municipal Act and Section 306 of the Madras District Municipalities Act give details of the various subjects for which bye-laws (not inconsistent with the Act) may be framed by municipal councils.

The Madras Local Boards Act deals with "Public Health, Safety and Convenience" in Chapters VIII to XI and the sections contained therein, although not so elaborate as in the Municipal Acts, pass over much the same ground.

Schedule V of the Madras City Municipal Act, Schedule IV (Part II) of the Madras District Municipalities Act and Schedule V of the Local Boards Act give lists of objects connected with the public health on which expenditure of municipal or local board money is authorised, and these schedules deserve close study by all Municipal and District Health Officers.

Section 287 of the Madras City Municipal Act, Section 249 of the Madras District Municipalities Act and Section 193 of the Local Boards Act legislate for the control of offensive trades; and in Schedule V, Schedule VI and Schedule VII, respectively, of the three Acts, lists of offensive trades are given for which premises may not be used without a license. Every Health Officer and Sanitary Inspector should make himself familiar with these sections and schedules and should consult the volume of model bye-laws issued by Government under the public health clauses of the District Municipalities and Local Boards Acts. Various rules have also been framed under Section 303 of the District Municipalities Act and Section 199 of the Local Boards Act and are included in the model bye-laws. A large number of the recommendations included in the model bye-laws are based on standards laid down in English bye-laws, although it was recognized that many Municipal Councils and Local Boards would not be in a position to enforce these standards for many years. At the same time, it was decided that if the bye-laws and rules were to be "model", they ought to comply with modern ideas of sanitation and hygiene, and it is left to Municipal Councils and Local Boards to adapt them to meet local circumstances. It is to be hoped, however, that the standards will not be reduced too freely. It is always of advantage to aim high, and any sweeping deletions will react at once on the locality concerned and hamper legitimate progress in public health work. Where it is considered necessary to frame additional bye-laws or to prescribe additional details, care should be taken to avoid any unreasonable or unduly stringent conditions as the Government would be probably unwilling to sanction any such increased stringency unless local circumstances make it obviously essential.

The model bye-laws should be used as a standard so that as great uniformity as possible may be maintained among the various self-governing bodies in the Presidency, local circumstances always being given due consideration. Such uniformity will make for expedition in the sanction of Government to proposed bye-laws sent up by Municipal Councils and Local Boards, and will also make it certain that nothing is included inconsistent with the Acts under which the bye-laws are framed.

"Dangerous Disease" is defined in the preliminary chapter of the Madras City Municipal Act; but Schedule VI of the Madras District Municipalities Act and the same schedule of the Local Boards Act give a list

of "dangerous diseases" to which the sections of the Acts dealing with prevention of disease refer. These diseases are anthrax, chicken-pox, cholera, diphtheria, enteric fever, glanders, leprosy, plague, small-pox and tuberculosis.

In both Municipal Acts, and in the Local Boards Act, a section refers to penalties for contravention of the general provisions of the Acts, and these penalties are given in detail in Schedules VIII and IX of the Local Boards Act. All Health Officers, Health Inspectors and Municipal Sanitary Inspectors should be thoroughly acquainted with these schedules and the penalties (both ordinary and for continuing breaches) sanctioned by law. It should frequently be possible to set matters right without resort to prosecution before a Magistrate, but the health official must know when and how to conduct a prosecution and what penalty can be demanded.

The Madras Village Panchayat Act, 1920: This Act was framed in order to make provision for the administration of village affairs by the villagers themselves, and thereby develop the system of self-government in the rural areas of the Presidency of Madras. The Local Government may, by notification, direct the constitution of a panchayat for any village, the number of members being not more than fifteen and not less than seven. A panchayat may exercise certain powers and perform certain duties concerned with public health, *e.g.*, water-supply, construction of drains and disposal of drainage water and sullage cleansing, provision of latrines, registration of births and deaths and enforcement of vaccination, etc. It may also levy taxes and fees on certain trades and professions, for cattle stands, cart stands, markets, slaughter houses, for the cleansing of private latrines, etc., and it may also frame bye-laws for carrying out the purposes of the Act. The Government have appointed a Registrar-General of Panchayats who is responsible for the working of all village panchayats, and the number in existence is gradually but steadily increasing.

The Madras Town Planning Act, 1920: This Act was passed in order that "the development of towns should be regulated to secure to their present and future inhabitants sanitary conditions, amenity and convenience." The Local Government has appointed a Director of Town Planning and various schemes of town extension have already been prepared or are in course of preparation. The Act provides for arbitration in cases of dispute, for land acquisition, and for the formation of Town Planning Trusts. A Madras City Town Planning Trust has been at work for some time past on several schemes which should help to relieve the congestion now existing in a number of areas in the City.

The Madras Town Nuisances Act, 1899: This Act contains sections laying down penalties for depositing dirt, filth or rubbish in any public street, road or thoroughfare ; for committing a nuisance in a street ; for neglecting to fence or protect any well, tank or other dangerous place or structure ; and for causing any offensive matter to run from any house, factory, dung heap or the like into a street. These nuisances can probably now be dealt with more conveniently under the two Municipal Acts ; but a useful section gives power to district and sub-divisional magistrates to destroy stray dogs.

The Indian Factories Act, 1911 (*as modified upto the 5th March* 1923); This Act contains a chapter dealing with "Health and Safety," and in it are to be found provisions relating to sanitation, ventilation, lighting, purity of water supplies, latrine and urinal accommodation, fencing of machinery, the prohibition of employment of women and children in certain dangerous work and restrictions as to employment of women and children in certain dangerous work, and restrictions as to employment of women and children under 18 years of age in certain processes. Under the Act, the Local Government may frame rules fixing standards, *e.g.*, of water-supply, of ventilation and of latrine and urinal accommodation and various penalties are also laid down for breach of the provisions of the Act or of the rules framed under the Act. District and Municipal Health Officers have been appointed under the Act as additional Inspectors of Factories and they are required to report on the sanitary requirements of factories. Rules have been framed under Section 37 relating to sanitary conditions, prevention of overcrowding, standard of ventilation and provision of sanitary accommodation and drinking water.

The Registration of Births and Deaths Act, 1899: This Act makes provision for the registration of births and deaths in rural tracts. The Local Government may by notification extend the Act of any portion thereof, to any local area outside municipal limits, and on the publication of such notification, the District Collector proclaims by posting notices at the village chavady or other conspicuous place, by beat of drum and by publication in the District Gazette, the date from which registration of births and deaths will be compulsory in the said area. The Government also may frame forms of registers, rules for the conduct of duties of Registrars and generally to carry out the provisions of the Act. Registrars are appointed under the Act, and information of births should be given to the Registrar

within two weeks by the father, or by the midwife assisting at the births or by an adult male resident in the house. Information of deaths must similarly be given within 4 days, but in the case of births and deaths occurring in a hospital, the medical officer in charg e is required to send notice to the Registrar. In areas where registration is compulsory under this Act, failure to notify births or deaths makes the responsible party liable to a fine not exceeding Rs. 10.

As regards registration of births and deaths in railway premises, the Traffic Manuals of the Madras and Southern Maharatta Railway, the Bengal and Nagpur Railway and the South Indian Railway contain rules on the subject. The station-masters are Registrars of births and deaths for births occurring within their station limits, and by regulation are ordered to maintain registers in which all births and deaths are entered. Village Officers and Chairmen, Municipal Councils should arrange to receive from station-masters, on the last day of every month, returns of births and deaths occurring within railway limits lying in rural or municipal areas as the case may be.

The Epidemic Diseases Act, 1897: This provides for the better prevention of the spread of dangerous epidemic disease. The Government of India by this Act has the power to take special measures and prescribe temporary regulations if an outbreak of any dangerous epidemic disease is threatened. Under Notification No. 2256 of the Home Department, dated 22nd December 1906, the Government of India conferred certain powers to the Provincial Governments under the Epidemic Diseases Act, 1897, for the purpose of preventing the outbreak of spread of plague ; but Local Governments have no power to apply the provisions of the Act to any other disease without the express sanction of the Government of India.

Two sets of regulations have been formulated under this Act ; one applies to the City of Madras only, and the other is in force outside the Presidency town. These regulations embody the special powers conferred on officers of the Government and other persons and the special obligations laid upon the public in connection with plague. Obstruction of the former or breach of the latter renders a person liable to prosecution and punishment under Section 186 of the Indian Penal Code. District and Municipal Health Officers have been appointed as special plague officers under the regulations. All officers having to do with public health must have an intimate knowledge of these regulations, and especially with the standing orders which contain departmental instructions for the guidance of officers dealing with plague.

The Madras Prevention of Adulteration (Foods and Drugs) Act 1918 : This was passed into law in order to prevent the adulteration of food. " Food " is defined in the Act as " every article (other than drugs or water) used by man for food or drink and all material used or admixed in the composition or preparation of such article and shall also include flavouring matter and condiments." "Butter", "Cheese," and "Ghee" are also defined. The appointment of a Public Analyst was made and he is now engaged in fixing standards for various kinds of foods. The sections of the Act clearly define the powers of local executive officers for purposes of inspection and seizure of adulterated foods, the method of sending such articles to the public analyst after seizure, the powers of a Magistrate to deal with adulterated foods ; and the methods to be adopted by a local executive officer in purchasing samples of suspected food for analysis. A schedule to the Act gives the form of certificate prescribed for the use of the public analyst in issuing reports on his analyses.

The public analyst appointed by Government, submitted his first report on food standards in 1926. He found that the Madras Prevention of Adulteration Act, 1918, was defective in certain respects and recommended that it required amendment before it could be applied properly. An amending bill was prepared and presented to the Legislative Council and it has been revised by a Select Committee of the Council.

The Indian Penal Code (as modified upto 1890): It lays down in Chapter XI a series of penalties for offences affecting public health, safety and convenience. These offences include the committal and continuance of public nuisances, the negligent spread of the infection of dangerous disease, the adulteration of food or drink or drugs intended for sale and the fouling of any water.

It has already been noted that breach of the provisions of the Epidemic Diseases Act is punishable under Section 188 of the Penal Code.

The Code of Criminal Procedure (Act V of 1898): It contains several sections dealing with public nuisances, their removal and prevention and the penalty for default.

Indian Ports Amendment Act, 1911: Attention has already been drawn to the powers of the Local Government to make rules for " the establishment and regulation of places to be used as sanatoria for the segregation, or as hospitals for the treatment of persons who are or have been recently suffering from any dangerous infection or contagious disease and for regulating the action to be taken" when cases of dangerous,

contagious or infectious diseases occur in ships entering into, or leaving, or for the time being in, any Indian port. The rules in force are very stringent and the greatest care should be taken that they are rigidly adhered to in every case, as they have been framed in accordance with international agreements.

The Railway Traffic Manuals lay on station-masters the duty of reporting the occurrence of cases of cholera, small-pox or other epidemic disease to the headman or in his absence the karnam of the village in which the station is situated.

Conclusion: In the absence of a Public Health Act for India, the administration of public health labours under grave disabilities and it is high time that such an Act, embodying the public health regulations now distributed among a number of minor statutes was added to the laws in force in this country. In this connection, it may be remarked that the sections in the present Local Self-Government Acts dealing with public health give local bodies a very free hand in questions which affect not only the area included within their own boundaries, but also neighbouring districts and may be the whole Presidency. The Public Health Department has purely advisory functions, but when its advice is rejected without reason, the Government has statutory powers by which it can compel recalcitrant local bodies to take at least reasonable precautions against infectious disease. It is only reasonable that a local body should be compelled to carry out measures which on the advice of the Public Health Department, Government consider necessary for the safety and welfare of the community. Moreover, all local bodies should each year set aside definite sums, or definite percentages of their income for the development of public health measures. The Acts in force require considerable amendment in different directions. Laws, rules, regulations and bye-laws on paper are totally ineffective without measures compelling their practical application. The model bye-laws framed under the Local Boards and District Municipalities Acts are cases in point. These bye-laws were drawn up in accordance with present law; permission was granted to local bodies to modify them in accordance with local requirements, and, if applied properly, there would be a tremendous lever in the hands of those anxious to improve local sanitary conditions. The fact is that they are more or less a dead letter. The Sanitary Code laid down by Government should be modern in every particular and should be incorporated, as already suggested, in an up-to-date Public Health Act. With the advice of a Central Board of Health, nominated by Government, the Director of Public Health should be empowered to promulgate new regulations, as they are deemed necessary, and in the absence of public opinion, Government should insist on all public health regulations being carried out by local bodies as strictly as is compatible with their financial position.

APPENDIX XVIII

FAMINES AND SCARCITIES IN MADRAS STATE

It is proposed in this appendix to give a short account of the famines and scarcities of Madras State during the last two centuries. Indeed in the last century no year has passed without distress being felt in some quarter, from severe loss of crops, occasioned by failure of the seasonal rains. The chief cause of these scarcities is described, in a letter to the Court of Directors as far back as 1733, to have been the neglect of the irrigation works which had taken place, since the agents of the Moghul Emperor had obtained possession of the country. It also appears that during the five years preceding 1733, considerable inconvenience had been occasioned in the settlement of Fort St. George, owing to the high price of grains, so much so, that in early 1729, the Government decided that rice should be sold at 13 measures per rupee and ragi at 16 measures per rupee.

The Famine of 1781-82

The first serious famine of which there are accounts, took place in 1781 and 1782. The Carnatic had been devastated by Hyder Ali's incursion in 1780–81 and the settlement of Madras was reduced to great straits for food ; as the whole country within its vicinity was suffering from a general scarcity. Early in 1781, the Government of Madras remitted all import duties on grain and called upon the officers-in-charge of subordinate settlements to forward all available grains to the Presidency. On the 20th May, the Government appointed a " Grain Committee " to superintendent the daily distribution of grain. After a careful enquiry the Committee came to the conclusion that the grain available can support the population only up to the end of June, and so the daily sales were further restricted. In July, the Committee felt that a considerable quantity of grain is concealed by merchants in different parts of the town. Government thereupon removed all the restrictions on the sale of grain and further decided to supply the Committee 400 bags of rice daily (sufficient to support about 60,000 people).

Matters appear to have remained at this stage for the next six months, but in January 1782, the pressure of the distress had become much more severe, dying objects were stated to be constantly met with in the streets and a public subscription was raised for the relief of the poor. The Monegar Choultry seems to have had its origin at this juncture and in May, nearly 4,000 persons were fed at this place. But the pressure on this institution was mounting up and Government decided to send 9,000 persons to Circars, 3,000 to Ganjam and 2,000 to Vizagapatam where provisions were plenty at that time. In October, Government took the supply of rice and foodgrains into their own houses. This was followed by wide protests in a public meeting on 11th October, but the recommendations of the meeting did not find favour with Government. Fortunately, the scarcity appears to have come to an end in the early months of 1783 and Government had plenty of stock of rice.

Scarcity of 1799

In the early part of 1799, there was considerable distress in the district of Dindigul in the South, and the Collector was permitted to purchase grain on the Government account for the purpose of retail sale to the people. In the event of the scarcity becoming more severe, he was authorised to dispose of what grain, he had in store, or could collect, at a loss in order to lower the general price of grain. It is not clear, however, whether he found it necessary to adopt this extreme measure.

The Famine of 1805–07

Five years later, or towards the close of 1804, the season was so unfavourable, as to cause severe pressure on the poorer classes in the Thanjavur and South Arcot districts. Early in 1805, the scarcity in these two districts had been so severe, that the Collector of Thanjavur recommended an embargo on export of rice and the Collector of South Arcot suggested that the importation of rice should be undertaken. In the latter part of 1805, there was a general failure of crops throughout the Presidency and on the advice of the Board of Revenue, the Government of Madras decided to organise relief measures. Nearly 2,000 persons were employed in the neighbourhood of Madras. The famine was most severe in the districts of North Arcot, Chingleput and Madras though it was partially felt in South Arcot, Thanjavur and Tiruchirapalli. A very considerable outlay upon public works and some advances to the people for the purpose of the sinking of wells were sanctioned in North Arcot and Madras, but notwithstanding these measures of relief, a considerable number of inhabitants are stated to have perished from the famine. Though in April it was reported that no pressure was likely to be felt in Tiruchirapalli, in September, the accounts of the district were so alarming that a large supply of Government rice had to be despatched at once.

In the absence of any measures for the relief of the sufferers in the distressed districts by the distribution of food or the sale of grain at low rates large number of people emigrated to Madras, and besieged the gates of the Monegar Choultry. This institution did much towards the relief of the starving applicants and all the able-bodied were given employment on the public works in the neighbourhood of the Presidency town. For seven months, an average of 2,500 persons, who, from the debility of infancy or extreme age, infirmity, sickness, or any other cause, were unable to minister to their own wants, were fed gratuitously at this institution. Four Branch Depots were also opened, and in the month of August, 15,000 persons were thus provided relief. There was considerable mortality among the persons who were provided with relief, partly from disease and partly from actual starvation, many having died soon after their arrival. The famine seems to have ended by October 1807, and those of the poor who had survived were sent back to their homes. No complete record of the number of deaths which took place either in Madras or in the other districts as a consequence of this famine is obtainable, but from the following recorded deaths in Madras during 1805--07, it would appear that the mortality in 1807 was very serious.

1805	...	3,225
1806	...	4.902
1807	...	17,207

The 1812-14 Scarcity

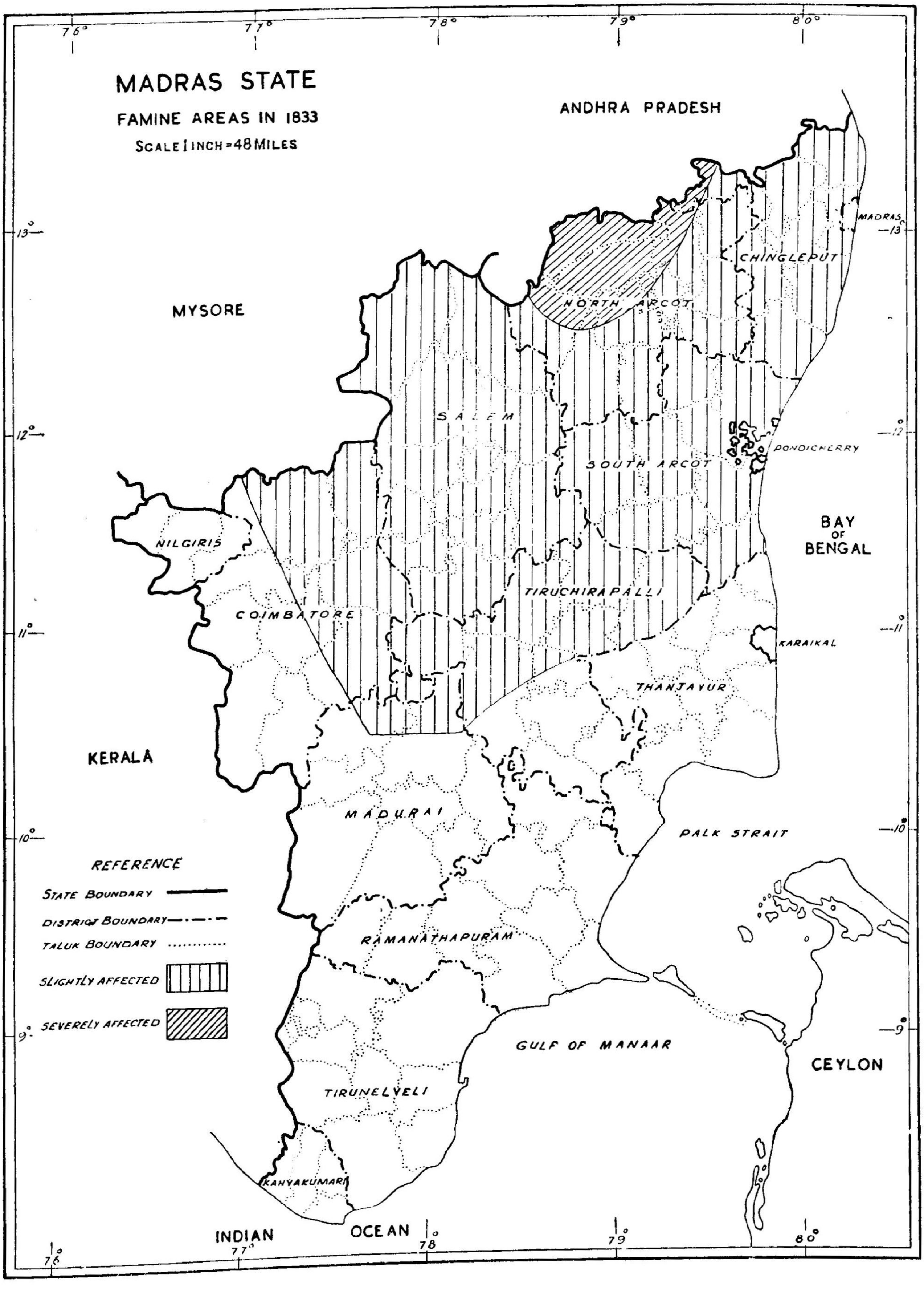
The season of the year 1811 was unfavourable in some southern districts. No serious distress appears to have been generally experienced throughout the State on this occasion, but the district of Madurai suffered considerably in the years 1812-13, and in the early part of 1814, and nearly 42,000 people in that district had to be provided with relief.

The 1824 Scarcity

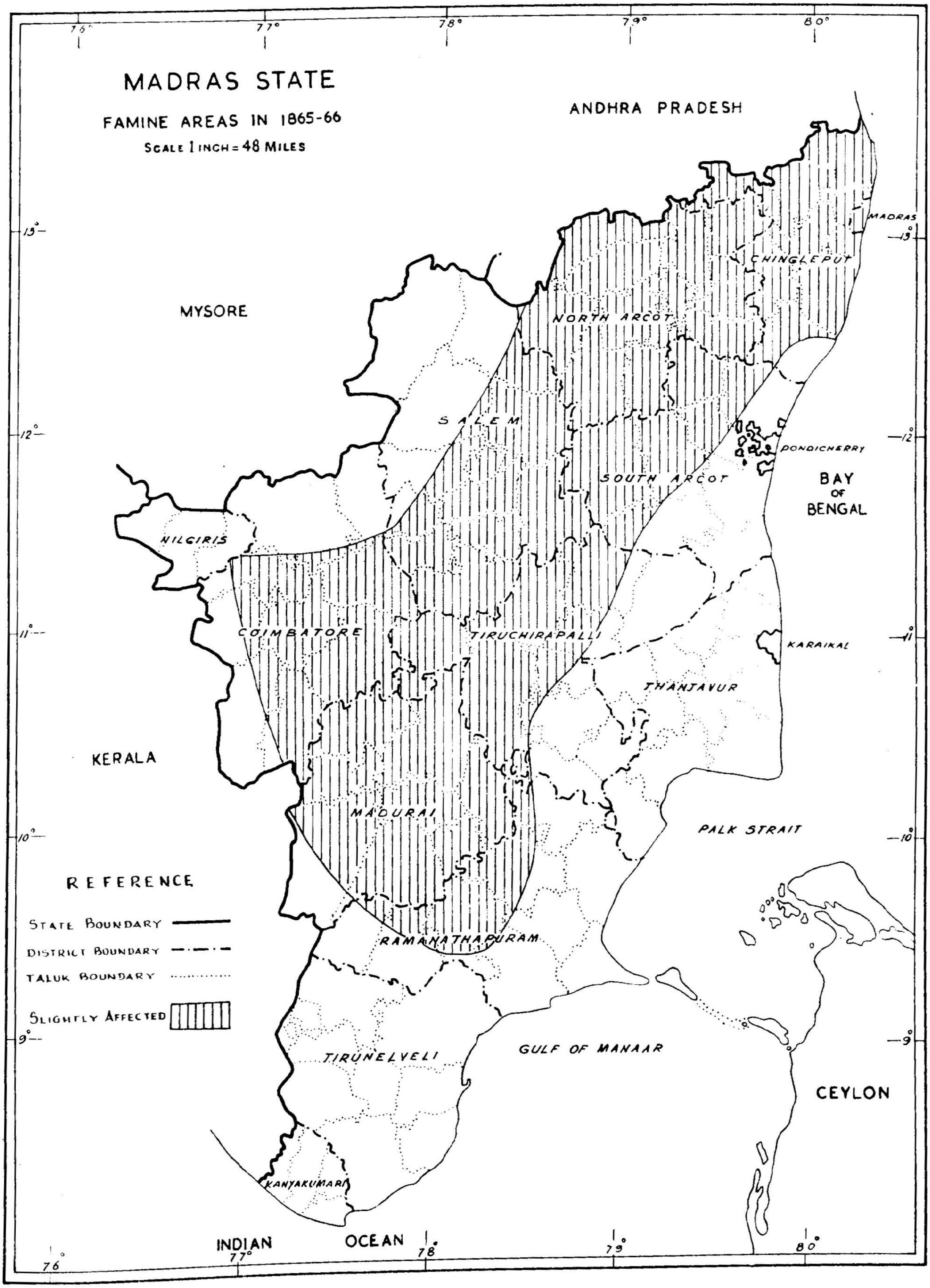
The next general scarcity of which there are many reliable accounts, took place in 1824. By December 1824, the scarcity was felt in the town of Madras and several deaths from starvation were reported, many children were abandoned by their parents and a serious grain riot took place in Madras town. The distress seems to have been very serious at an early period in the North Arcot District and the Collector inquired whether the merchants were to be allowed to sell at their own rates, or whether government would interfere and fix the prices. It was further found necessary early in 1824 to give State employment to considerable number of persons in Salem, North Arcot, South Arcot and Madras. About the middle of the year, the distress among the poorest classes had increased to such an alarming extent, that it became necessary to feed considerable numbers of those unable to labour, both in the town of Madras and in the districts of Madras and North Arcot. In the latter district, rice was selling in July at 4½ seers per rupee in some places. In Madras, the Relief Depots were managed by the committee of the Monegar Choultry, to whom Government gave grants-in-aid, and the government officers managed them in the districts. The expenditure on relief at each Depot was about one rupee per head, per mensem. The recipients of relief were divided into two classes, those able to work and those unable to do so, and each was supplied with a ticket entitling him to a sufficient dole of cooked food to preserve life ; the rations however were so arranged that the recipients were never tempted to continue a burden on charity, when a better provision could be obtained by ordinary labour. The work required of these paupers was of such a nature as might appear most useful, but it was to be determined upon, not so much in regard to the value of the work performed as to the object of allowing none to eat the bread of idleness who were capable of earning a livelihood. In the town of Madras, several thousand persons were fed at four separate Depots for several months. In the Chingleput and Madras districts, about seven thousand persons were also fed on the same principles, for three months. The season in October and November was fortunately propitious, and all the Relief Depots appear to have been closed by the end of the year.

The Famine of 1833

After an interval of nine years or in 1833, occurred the most serious famine with which the Madras Presidency has been afflicted since the British accession occurred. This famine was referred to as the Guntur Famine because of its severity in the Andhra district of Guntur but nevertheless the famine was widespread in many Tamil districts, with lesser intensity. It was found necessary to sanction a large expenditure on public works in the districts of Salem, Tiruchirapalli, Coimbatore and South Arcot in order to provide labour for the poorer classes and in the North Arcot district those who were unable to do work would have perished had not some Government Relief Depots been opened, where they obtained cooked food. In February, 1,500 people were being fed at the Monegar Choultry in Madras, and a large number of paupers flocked to this institution from the northern districts and North Arcot, in this and the following months, so much so, at the beginning



MADRAS STATE
FAMINE AREAS IN 1833
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
SOUTH ARCOT
PONDICHERRY
BAY OF BENGAL
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
MADURAI
PALK STRAIT
RAMANATHAPURAM
GULF OF MANAAR
CEYLON
TIRUNELVELI
KANYAKUMARI
INDIAN OCEAN
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
SLIGHTLY AFFECTED
SEVERELY AFFECTED
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°


MADRAS STATE
FAMINE AREAS IN 1865-66
SCALE 1 INCH = 48 MILES
ANDHRA PRADESH
MYSORE
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
PONDICHERRY
SOUTH ARCOT
BAY OF BENGAL
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
KERALA
MADURAI
PALK STRAIT
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
SLIGHTLY AFFECTED
RAMANATHAPURAM
TIRUNELVELI
GULF OF MANAAR
CEYLON
KANYAKUMARI
INDIAN OCEAN
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°

of May there were about 12,000 persons belonging to these districts who were fed there.

A lamentable picture of the distress in the Madras town was given in the local journals of the day. Rice was selling at seven measures per rupee in many places and in Vellore at 3½ measures per rupee. Groups of people were seen dying of starvation in the streets every day and the number of applicants for relief at the Monegar Choultry was quite beyond the means of the institution. Such large crowds of starving paupers had reached Madras that the outbreak of some serious epidemic was apprehended by the medical officers and in April, the Government issued orders strictly requiring all Collectors not to permit the poorer people of their district to emigrate to Madras, but to provide them with employment and food, if necessary near their own homes. In the same month, it became necessary in South Arcot to grant advances, repayable in two years, for sinking wells.

By August, matters were much worse everywhere. Serious grain riots occurred in Madras, but were quelled by the aid of troops without any loss of life. In Vellore, rice was selling at 4½ measures per rupee and the distress was dreadful. The town witnessed the horrible spectacle of a mother devouring her dead infant in the streets of the town. Notwithstanding the efforts to relieve the distress and large expenditure incurred in feeding and employing the people in the different districts, people were still flocking to Madras. In September, more than 70,000 persons were fed at the Monegar Choultry and the subordinate Depots and 10,000 persons were employed in the neighbourhood. Several of them were employed on the northern trunk road and provided with subsistence by Government. In addition to the enormous expenditure incurred in the Madras Town for relieving distress, Rs. 20,000 was spent in South Arcot district, Rs. 32,000 in Madras district and smaller sums in Madurai, North Arcot and Salem districts. The scarcity was at an end with the harvest of 1834. There are, unfortunately, no accessible returns from which we can estimate the number who died of the 1833 famine.

The Famine of 1866

Though the two years 1864 and 1865 had been generally unfavourable to agriculture, there was no serious apprehension in March in the districts of North Arcot, South Arcot, Tiruchirapalli, Salem and Madurai, which were afterwards the scene of such serious distress and no anticipation of the coming disasters were then entertained in Coimbatore. In the month of June, the state of affairs became really critical. The rains, usual in this month, failed in many parts of the country. All agricultural operations were brought to a standstill and that class of people who live by daily labour were reduced to very great straits. In Salem, North Arcot and Coimbatore, the distress was increasing day by day. The people were emigrating from some parts of North Arcot and in Salem, many persons were subsisting on roots, leaves and the fruit of the prickly pear, the prices of grain having risen to such high rates beyond the reach of the poorer classes. In August, relief measures were started in North Arcot, South Arcot, Salem and Coimbatore, but the advantages of these measures were not fully obtained by the people until September or October. The General Relief Committee constituted in July addressed all persons of influence to raise funds for relief and the Collectors were provided with grants-in-aid and they were asked to keep the Committee informed about the condition in their respective districts.

In August, Relief Depots were opened by the aid of contributions from the General Relief Fund in Salem, North Arcot, South Arcot, Coimbatore and Madurai districts and employment was found on public works for all those who were capable of work. In September, Tiruchirapalli joined the list of distressed districts, and though the season began to improve in October, there was considerable suffering in the months of June to November and the pressure was more severe in some portions than in others in the distressed districts. The upland taluks of Salem, North Arcot, and Coimbatore suffered most followed by those taluks of Thanjavur district where dry cultivation was carried on, and the taluks of Melur and Tirumangalam of Madurai district. In Tiruchirapalli district, the distress was confined to the Tiruchirapalli town. In North Arcot over 8,000 persons were fed during August, September and October. The numbers fed in Salem nearly reached 7,000 in September and over 5,000 were being fed in Madurai in September and October. In Tiruchirapalli, over 4,000 were fed in September and a similar number in the Madras Town in November. In Coimbatore, the number was less than 2,000.

The Famine of 1876-78

The south-west monsoon rains of 1875 were scanty and late, so that unfavourable season and crop reports were received from the districts of Chingleput, North Arcot, South Arcot, Thanjavur, Tiruchirapalli, Madurai, Coimbatore, Salem and Nilgiris. In January 1876 there were widespread reports from these districts of great want of water and loss of crops from drought. The Collector of Salem reported in February 1876 on the exceptional character of the season in the district and

asked for grant of funds for organising relief measures, but his request was not granted. Consequent on the failure of the north-east monsoon, relief measures were sanctioned in Tirunelveli, Chingleput and South Arcot districts in May. In June 1876, the Collector of Madurai stated his opinion that there were no indications from which he could discern that the district was entering on a period of scarcity, although the north-east monsoon had failed. The attitude of the Madras Government was one of watchfulness. As early as the month of July they had sounded a note of warning to the Government of India.

The districts of Madras State which suffered actual famine may be divided into two classes. First, the early famine districts in which food scarcity began to be felt in 1876, and the later famine districts in which the unseasonable weather of 1877 converted scarcity and high prices into famine. The former districts are Madras, Chingleput, North Arcot, Salem, Coimbatore and Madurai while the districts falling in the latter category are South Arcot, Tiruchirapalli, Tirunelveli and Nilgiris.

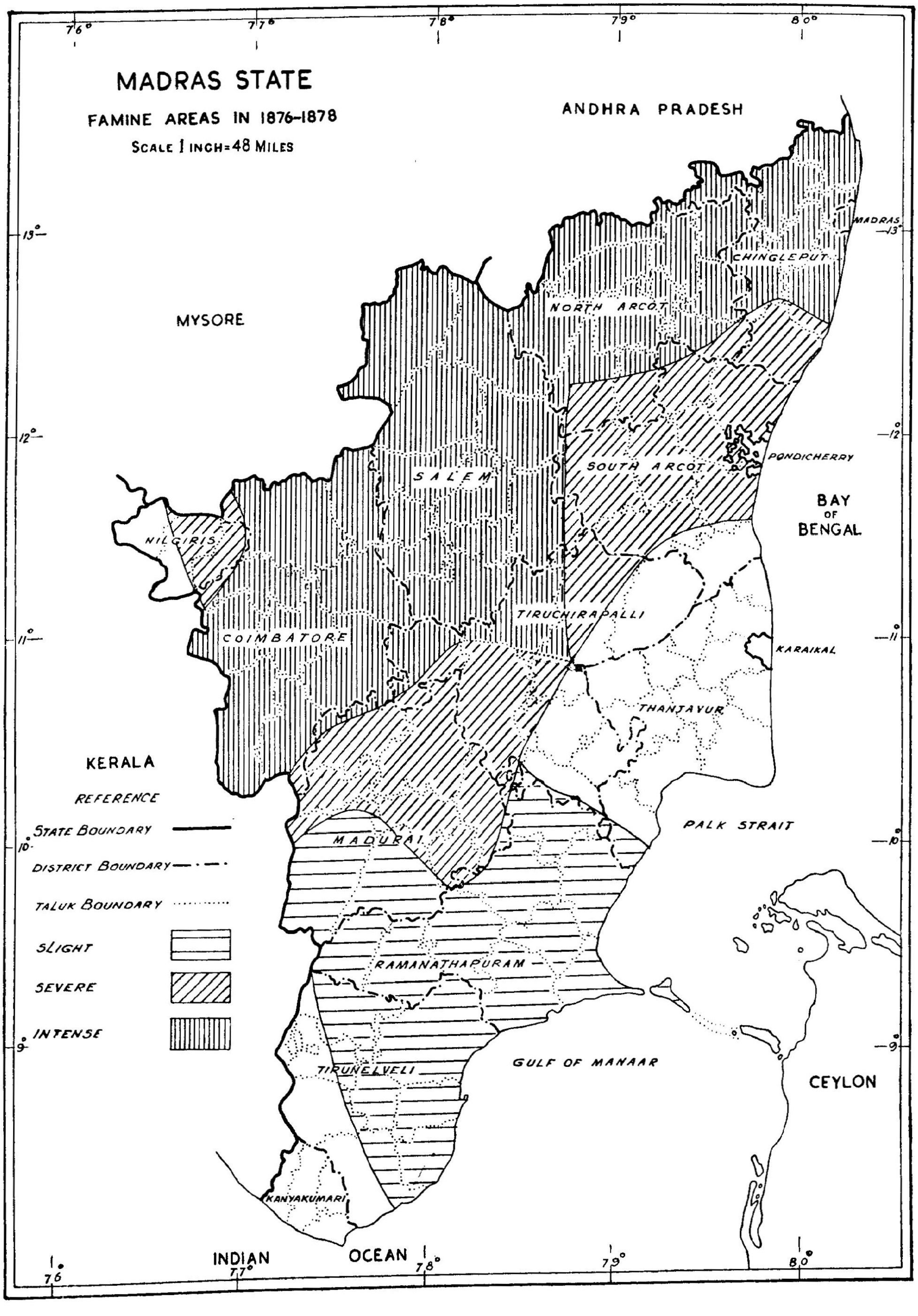
According to Dr. Cornish there was an annual death rate of 930.8 per mille of the population of the Madras Relief Camps, which is big enough to wipe out the whole population in a year. A similar situation existed in all relief camps. The deaths were not due to cholera or small-pox but were almost entirely due to diseases which invariably attack under-fed and starved people *viz.*, extreme wasting of tissue, and destruction of lining membrane of the lower bowels. The following figures furnished by Dr. Cornish give a picture of the losses, if not the whole truth of the famine.

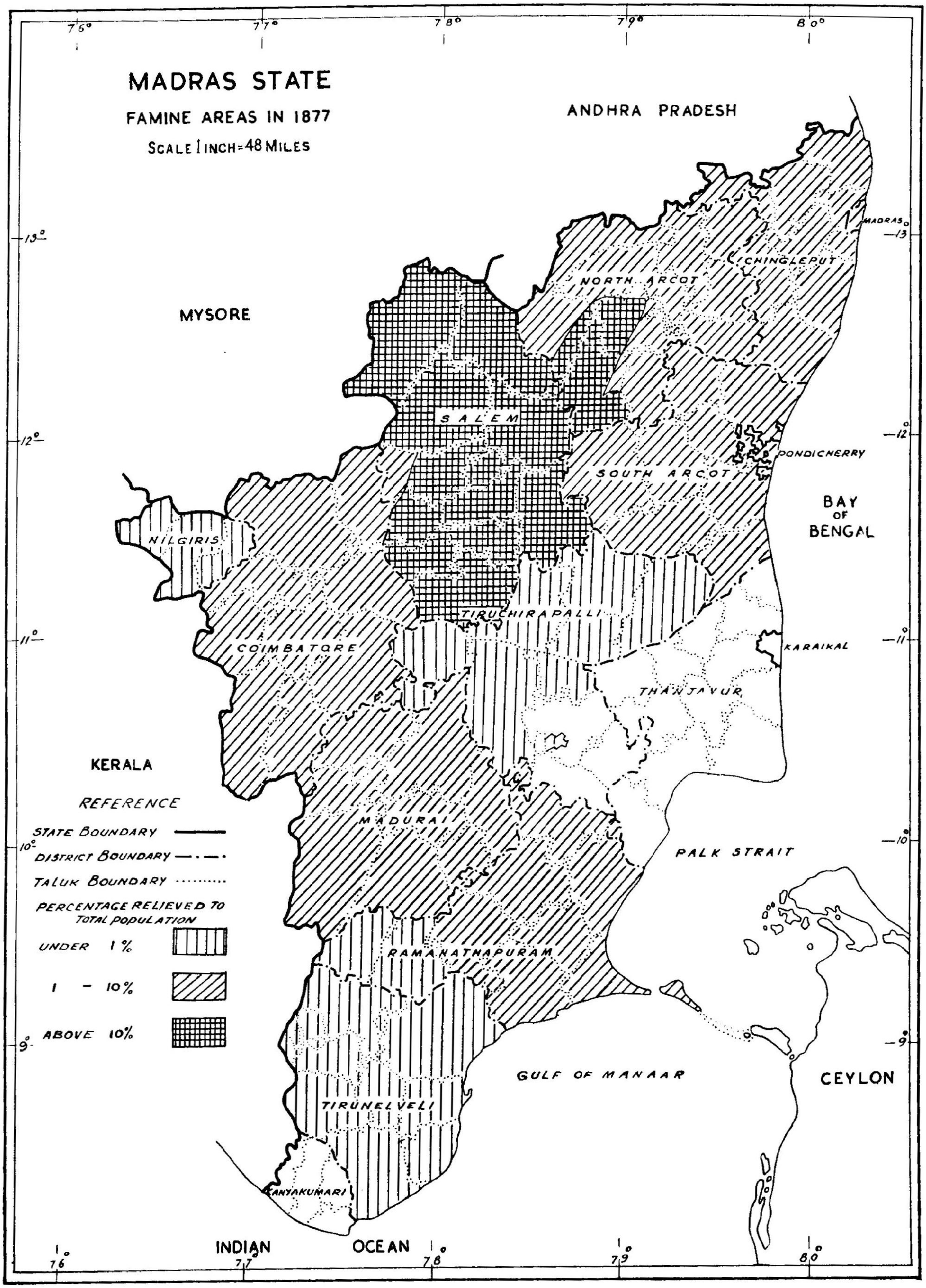
Mortality in Famine Districts, 1876

Details	*Chingleput*	*North Arcot*
(1)	(2)	(3)
Population ...	938,184	2,015,278
Registered Deaths		
Average of 5 years ending 1875		
December ...	1,892	3,445
January ...	1,404	3,943
Present Season		
1876 December ...	2,865	6,046
1877 January ...	6,094	13,686
Ratio of Registered Death per 1,000 *of population*		
Average of 5 years (two months) ...	21.1	21.9
Present season (two months) ...	57.2	58.7

Mortality in Municipalities of Famine Districts, 1876

Details	*Madras*	*Kanchipuram*	*Vellore*	*Wallajapet*
(1)	(2)	(3)	(4)	(5)
Population	397,552	37,327	38,022	12,103
Registered Deaths				
(Average for 5 years ended 1875)				
December	1,211	65	84	41
January	1,260	65	81	30
February	1,100	65	80	26
Present Season				
1876 December	2,034	96	89	48
1877 January	4,059	367	146	66
1877 February	4,401	87	215	41
Ratio per 1,000 *of population per annum*				
Average of 5 years (3 months)	35.9	20.8	28.4	32.0
Present season (3 months)	105.5	58.9	47.3	51.2


MADRAS STATE
FAMINE AREAS IN 1876-1878
SCALE 1 INCH=48 MILES
ANDHRA PRADESH
MYSORE
KERALA
BAY OF BENGAL
PALK STRAIT
GULF OF MANAAR
CEYLON
INDIAN OCEAN
MADRAS
CHINGLEPUT
NORTH ARCOT
SOUTH ARCOT
PONDICHERRY
SALEM
NILGIRIS
COIMBATORE
TIRUCHIRAPALLI
KARAIKAL
THANJAVUR
MADURAI
RAMANATHAPURAM
TIRUNELVELI
KANYAKUMARI
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
SLIGHT
SEVERE
INTENSE
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°



MADRAS STATE
FAMINE AREAS IN 1877
SCALE 1 INCH=48 MILES
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
PONDICHERRY
SOUTH ARCOT
BAY OF BENGAL
NILGIRIS
TIRUCHIRAPALLI
COIMBATORE
KARAIKAL
THANJAVUR
MADURAI
PALK STRAIT
RAMANATHAPURAM
GULF OF MANAAR
CEYLON
TIRUNELVELI
KANYAKUMARI
INDIAN OCEAN
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
PERCENTAGE RELIEVED TO TOTAL POPULATION
UNDER 1%
1 - 10%
ABOVE 10%

The effect of the famine was severely felt on the old, the weak and the young children. A partial census in the famine districts of Madras State was taken on 15th March 1878 in one taluk of each of the severely stricken districts of Coimbatore and Chingleput and in all the taluks of Salem; a census was also taken in one taluk each of Tiruchirapalli, Thanjavur and Tirunelveli in parts of which distress was felt. The figures are given below:

Area covered		Population in 1878	Population in 1871	Population of 1871 plus increment of 1.5 per cent per annum from 1872–1876	Percentage increase or decrease	
					Columns (2) & (3)	Columns (2) & (4)
(1)		(2)	(3)	(4)	(5)	(6)
All taluks of Salem	...	1,559,896	1,977,034	2,129,852	— 21.1	— 26.8
Palladam taluk of Coimbatore	...	207,711	231,155	250,097	— 10.5	— 16.9
Ponneri taluk of Chingleput	...	100,460	103,675	111,690	— 3.1	— 10.0
Musiri taluk of Tiruchirapalli	...	266,647	255,132	274,854	+ 4.5	— 2.9
Mayavaram taluk of Thanjavur	...	242,999	221,749	238,887	+ 9.5	+ 1.7
Ambasamudram taluk of Tirunelveli	...	160,135	151,670	163,395	+ 5.5	— 1.9

These figures are indicative of the decline in population in two years of famine. According to Michael Kennedy, a part of the diminution of the population must be due to the decrease in births and another part due to an increase in mortality and a still another part is due to migration whose number cannot be determined precisely. However, he thinks, that the number may be about 350,000. Further, cholera, small-pox and fever account for nearly two-thirds of the excess mortality during the period between the latter part of 1876 and the end of February 1878. According to Dr. Cornish, the loss due to the famine was over 3.25 millions, but if we exclude the Andhra districts, the loss from the Tamil districts will be over 20 lakhs.

The Famine of 1891–92

The distress which prevailed in 1891–92, commenced about the end of 1890 or the beginning of 1891 and was due at first to the failure of the north-east monsoon of 1890–91—a failure which was marked in Chingleput, North Arcot, South Arcot, Coimbatore, Madurai and Tirunelveli. A late and seriously deficient south-west monsoon in 1891 prolonged and deepened in Chingleput, North Arcot and Coimbatore the distress which a good monsoon would have otherwise removed. In February 1891, the Commissioner of Settlement in charge of relief operations reported that the districts which had suffered most severely from the failure of crops were Chingleput, North Arcot and Tirunelveli, but that even in those districts there was no immediate necessity for starting extraordinary relief works. In South Arcot and Madurai the areas in which the crops had been reported to have lost or to be in a critical condition were comparatively small and rain in the early months of 1891 had so much improved the fading crops that it was decided to remove this district from the affected list.

At the end of February, 1891, it was considered that the affected area comprised of Wandiwash taluk of North Arcot, northern taluks of Chingleput and portions of three others, seven taluks of Tirunelveli, of which four were only partially affected and portions of the

Coimbatore district. In most of the affected districts there had been some good rains in January and February, which though late to save a considerable portion of the wet crops, materially improved the prospects in Tirunelveli, and the serious anxiety was felt only in portions of Chingleput, North Arcot and Tirunelveli. In these three districts, large additional works were opened and by March there were over 2,200 minor irrigation works.

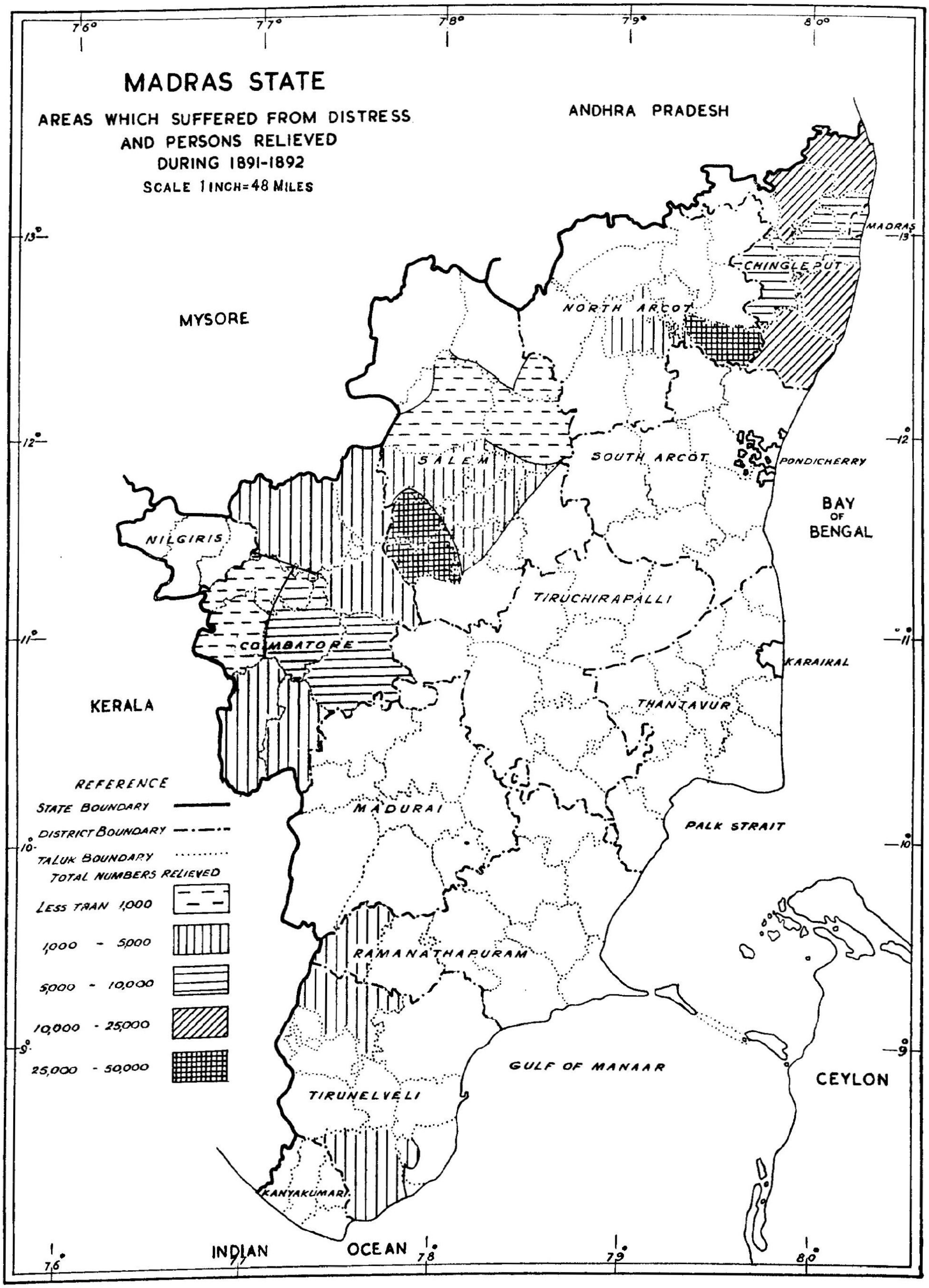
In the districts of Coimbatore, Salem, North Arcot and Chingleput, the total deaths reported in 1891 were only 25.8 % in excess of the average number of deaths for 5 years ended December 1890. The death rates in the affected districts were as follows :

Coimbatore ...	21.5	Chingleput ...	28.3
Salem ...	20.6	North Arcot ...	22.0

Much of the excess mortality in the last two years was due to cholera, but its intensity was not confined to the famine districts. In spite of its prevalence, cholera did not affect the persons engaged in relief works, and the general health in the relief camps was good.

Famines and Scarcities in Madras State

Period	Famine (F) or Scarcity (S)	Affected Districts	Period of maximum intensity
(1)	(2)	(3)	(4)
1781–82 ...	S	Madras City ...	January 1782
1799 ...	S	Dindugal Taluk of Madurai District ...	January 1799
1805–7 ...	F	Chingleput, North Arcot, South Arcot, Thanjavur, Tiruchirapalli ...	March—October 1807
1812–14 ...	S	Madurai ...	January—May 1814
1824 ...	S	Salem, North Arcot, South Arcot, Madras ...	July—October 1824
1833 ...	F	Salem, Tiruchirapalli, Coimbatore, South Arcot, North Arcot ...	February—May 1833
1866 ...	F	Madras, North Arcot, Salem, Coimbatore, South Arcot, Madurai ...	September—December 1866
1876–78 ...	F	Madras, Chingleput, North Arcot, Madurai, Coimbatore, Salem ...	July—December 1876
		South Arcot, Tiruchirapalli, Tirunelveli, Nilgiris ...	January—April 1877
1891–92 ...	F	Chingleput, North Arcot, Salem, Coimbatore, Tirunelveli ...	July 1891 to March 1892



MADRAS STATE
AREAS WHICH SUFFERED FROM DISTRESS AND PERSONS RELIEVED DURING 1891-1892
SCALE 1 INCH=48 MILES
ANDHRA PRADESH
MYSORE
KERALA
MADRAS
CHINGLEPUT
NORTH ARCOT
SALEM
SOUTH ARCOT
PONDICHERRY
BAY OF BENGAL
NILGIRIS
TIRUCHIRAPALLI
COIMBATORE
KARAIKAL
THANTAVUR
MADURAI
PALK STRAIT
RAMANATHAPURAM
GULF OF MANAAR
CEYLON
TIRUNELVELI
KANYAKUMARI
INDIAN OCEAN
REFERENCE
STATE BOUNDARY
DISTRICT BOUNDARY
TALUK BOUNDARY
TOTAL NUMBERS RELIEVED
LESS THAN 1,000
1,000 - 5,000
5,000 - 10,000
10,000 - 25,000
25,000 - 50,000
76°
77°
78°
79°
80°
13°
12°
11°
10°
9°

APPENDIX XIX

DEATHS DUE TO SELECT DISEASES, 1956-60

DEATHS DUE TO CHOLERA, 1956-60

District	T/R/U	1956	1957	1958	1959	1960	1956-60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	...	414	63	64	...	541
	R	...	...	...	...	...	...
	U	...	414	63	64	...	541
Chingleput ...	T	...	93	66	83	2	244
	R	...	77	63	58	2	200
	U	...	16	3	25	...	44
North Arcot ...	T	...	105	136	11	5	257
	R	...	85	87	8	...	180
	U	...	20	49	3	5	77
South Arcot ...	T	1	118	435	19	3	576
	R	1	94	302	14	3	414
	U	...	24	133	5	...	162
Salem ...	T	...	124	171	...	...	295
	R	...	107	127	...	...	234
	U	...	17	44	...	...	61
Coimbatore ...	T	...	151	255	1	6	413
	R	...	58	196	1	5	260
	U	...	93	59	...	1	153
Nilgiris ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Madurai ...	T	...	47	371	...	1	419
	R	...	35	261	...	1	297
	U	...	12	110	...	...	122
Tiruchirapalli ...	T	...	502	184	5	1	692
	R	...	303	141	5	1	450
	U	...	199	43	...	...	242
Thanjavur ...	T	...	953	369	17	2	1,341
	R	...	834	266	17	1	1,118
	U	...	119	103	...	1	223
Ramanathapuram ...	T	...	19	71	1	...	91
	R	...	15	30	...	...	45
	U	...	4	41	1	...	46
Tirunelveli ...	T	5	403	185	4	...	597
	R	2	248	100	4	...	354
	U	3	155	85	...	...	243
Kanyakumari ...	T	...	1	6	1	...	8
	R	...	1	6	1	...	8
	U	...	...	...	...	...	...
State ...	T	6	2,930	2,312	206	20	5,474
	R	3	1,857	1,579	108	13	3,560
	U	3	1,073	733	98	7	1,914

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO SMALL-POX, 1956–60

District	T/R/U	1956	1957	1958	1959	1960	1956–60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	68	428	1,389	517	521	2,923
	R	...	...	...	...	...	...
	U	68	428	1,389	517	521	2,923
Chingleput ...	T	143	308	692	224	198	1,565
	R	118	229	596	210	156	1,309
	U	25	79	96	14	42	256
North Arcot ...	T	89	181	579	152	134	1,135
	R	65	139	390	120	109	823
	U	24	42	189	32	25	312
South Arcot ...	T	269	497	347	171	179	1,463
	R	204	299	279	147	121	1,050
	U	65	198	68	24	58	413
Salem ...	T	86	559	684	202	71	1,602
	R	42	343	603	185	60	1,233
	U	44	216	81	17	11	369
Coimbatore ...	T	55	309	475	339	83	1,261
	R	52	118	354	194	77	795
	U	3	191	121	145	6	466
Nilgiris ...	T	5	20	36	56	2	119
	R	5	12	29	34	2	82
	U	...	8	7	22	...	37
Madurai ...	T	17	225	210	109	149	710
	R	13	88	129	71	52	353
	U	4	137	81	38	97	357
Tiruchirapalli ...	T	66	411	166	106	71	820
	R	42	240	134	103	45	564
	U	24	171	32	3	26	256
Thanjavur ...	T	114	447	474	237	196	1,468
	R	87	305	390	170	149	1,101
	U	27	142	84	67	47	367
Ramanathapuram ...	T	76	285	178	54	58	651
	R	65	80	130	53	53	381
	U	11	205	48	1	5	270
Tirunelveli ...	T	141	147	144	45	78	555
	R	87	114	115	41	65	422
	U	54	33	29	4	13	133
Kanyakumari ...	T	...	76	124	13	4	217
	R	...	29	63	9	4	105
	U	...	47	61	4	...	112
State ...	T	1,129	3,893	5,498	2,225	1,744	14,489
	R	780	1,996	3,212	1,337	893	8,218
	U	349	1,897	2,286	888	851	6,271

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO PLAGUE, 1956-60

District	T/R/U	1956	1957	1958	1959	1960	1956-60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Chingleput ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
North Arcot ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
South Arcot ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Salem ...	T	1	1	...	7	14	23
	R	1	1	...	7	14	23
	U	...	...	...	...	...	...
Coimbatore ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Nilgiris ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Madurai ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Tiruchirapalli ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Thanjavur ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Ramanathapuram ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Tirunelveli ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
Kanyakumari ...	T	...	...	...	...	...	...
	R	...	...	...	...	...	...
	U	...	...	...	...	...	...
State ...	T	1	1	...	7	14	23
	R	1	1	...	7	14	23
	U	...	...	...	...	...	...

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO MALARIA, 1956-60

District	T/R/U	1956	1957	1958	1959	1960	1956-60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	33	18	14	8	4	77
	R	...	...	...	...	...	...
	U	33	18	14	8	4	77
Chingleput ...	T	89	61	104	89	70	413
	R	73	47	92	77	58	347
	U	16	14	12	12	12	66
North Arcot ...	T	207	129	102	39	94	571
	R	166	110	94	32	85	487
	U	41	19	8	7	9	84
South Arcot ...	T	34	63	65	31	20	213
	R	28	47	52	29	15	171
	U	6	16	13	2	5	42
Salem ...	T	485	355	499	183	139	1,661
	R	358	225	428	116	92	1,219
	U	127	130	71	67	47	442
Coimbatore ...	T	206	75	106	61	88	536
	R	170	51	86	36	70	413
	U	36	24	20	25	18	123
Nilgiris ...	T	21	20	7	22	5	75
	R	19	17	4	21	5	66
	U	2	3	3	1	...	9
Madurai ...	T	117	55	39	32	47	290
	R	81	37	29	23	39	209
	U	36	18	10	9	8	81
Tiruchirapalli ...	T	168	62	98	106	61	495
	R	149	46	86	103	54	438
	U	19	16	12	3	7	57
Thanjavur ...	T	103	38	81	22	21	265
	R	94	32	76	9	17	228
	U	9	6	5	13	4	37
Ramanathapuram ...	T	39	63	49	85	80	316
	R	23	54	47	75	65	264
	U	16	9	2	10	15	52
Tirunelveli ...	T	95	19	60	54	6	234
	R	87	17	56	53	3	216
	U	8	2	4	1	3	18
Kanyakumari ...	T	6	11	5	...	2	24
	R	3	10	4	...	2	19
	U	3	1	1	...	...	5
State ...	T	1,603	969	1,229	732	637	5,170
	R	1,251	693	1,054	574	505	4,077
	U	352	276	175	158	132	1,093

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO FEVERS, 1956-60

District	T/R/U	1956	1957	1958	1959	1960	1956-60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	3,165	2,707	3,895	1,125	1,478	12,370
	R	...	...	...	...	...	...
	U	3,165	2,707	3,895	1,125	1,478	12,370
Chingleput ...	T	4,101	3,247	3,601	3,513	3,307	17,769
	R	3,514	2,721	3,130	2,948	2,794	15,107
	U	587	526	471	565	513	2,662
North Arcot ...	T	9,069	11,448	10,932	9,950	9,342	50,741
	R	8,220	10,416	9,791	8,872	8,251	45,550
	U	849	1,032	1,141	1,078	1,091	5,191
South Arcot ...	T	6,590	6,609	4,782	4,815	6,226	29,022
	R	6,020	6,144	4,333	4,399	5,721	26,617
	U	570	465	449	416	505	2,405
Salem ...	T	7,860	9,692	8,073	7,830	7,261	40,716
	R	7,129	8,855	7,335	7,083	6,612	37,014
	U	731	837	738	747	649	3,702
Coimbatore ...	T	4,629	4,974	4,313	4,441	4,084	22,441
	R	4,214	4,342	3,748	3,886	3,493	19,683
	U	415	632	565	555	591	2,758
Nilgiris ...	T	758	667	610	674	503	3,212
	R	690	600	546	616	467	2,919
	U	68	67	64	58	36	293
Madurai ...	T	5,333	6,701	5,556	5,062	5,741	28,393
	R	4,230	5,166	4,042	3,661	4,268	21,367
	U	1,103	1,535	1,514	1,401	1,473	7,026
Tiruchirapalli ...	T	7,787	8,071	6,601	5,475	5,741	33,675
	R	6,998	7,113	5,837	4,786	5,130	29,864
	U	789	958	764	689	611	3,811
Thanjavur ...	T	3,174	3,795	3,303	2,422	2,843	15,537
	R	2,525	3,062	2,566	1,868	2,233	12,254
	U	649	733	737	554	610	3,283
Ramanathapuram ...	T	6,817	6,715	5,538	5,748	5,755	30,573
	R	5,515	5,309	4,368	4,615	4,591	24,398
	U	1,302	1,406	1,170	1,133	1,164	6,175
Tirunelveli ...	T	5,259	6,320	5,524	4,722	5,872	27,697
	R	3,924	4,741	4,050	3,405	4,484	20,604
	U	1,335	1,579	1,474	1,317	1,388	7,093
Kanyakumari ...	T	1,702	1,321	1,763	1,795	1,829	8,410
	R	1,109	849	1,169	1,348	1,358	5,833
	U	593	472	594	447	471	2,577
State ...	T	66,244	72,267	64,491	57,572	59,982	320,556
	R	54,088	59,318	50,915	47,487	49,402	261,210
	U	12,156	12,949	13,576	10,085	10,580	59,346

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO DYSENTERY AND DIARRHOEA, 1956-60

District	T/R/U	1956	1957	1958	1959	1960	1956-60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	5,416	5,185	5,078	4,885	4,731	25,295
	R	...	...	...	...	...	...
	U	5,416	5,185	5,078	4,885	4,731	25,295
Chingleput ...	T	2,048	2,188	2,667	2,299	2,409	11,611
	R	1,488	1,528	2,113	1,785	1,871	8,785
	U	560	660	554	514	538	2,826
North Arcot ...	T	5,012	6,139	5,929	4,645	5,683	27,408
	R	4,069	4,890	4,713	3,536	4,506	21,714
	U	943	1,249	1,216	1,109	1,177	5,694
South Arcot ...	T	2,836	3,904	2,719	2,375	2,735	14,569
	R	2,492	3,423	2,372	2,098	2,487	12,872
	U	344	481	347	277	248	1,697
Salem ...	T	1,546	2,148	2,574	1,988	2,186	10,442
	R	1,118	1,688	2,066	1,477	1,601	7,950
	U	428	460	508	511	585	2,492
Coimbatore ...	T	3,035	3,397	3,011	2,694	2,490	14,627
	R	1,981	1,798	1,972	1,608	1,588	8,947
	U	1,054	1,599	1,039	1,086	902	5,680
Nilgiris ...	T	228	184	194	276	256	1,138
	R	130	113	117	152	120	632
	U	98	71	77	124	136	506
Madurai ...	T	2,504	2,631	2,373	2,339	2,723	12,570
	R	1,469	1,432	1,195	1,308	1,534	6,938
	U	1,035	1,199	1,178	1,031	1,189	5,632
Tiruchirapalli ...	T	2,931	2,304	2,273	1,573	2,136	11,217
	R	2,256	1,772	1,800	1,165	1,634	8,627
	U	675	532	473	408	502	2,590
Thanjavur ...	T	1,912	1,718	2,043	1,228	1,204	8,105
	R	1,468	1,185	1,355	808	813	5,629
	U	444	533	688	420	391	2,476
Ramanathapuram ...	T	2,399	2,306	1,777	1,474	1,896	9,852
	R	1,562	1,382	948	808	1,121	5,821
	U	837	924	829	666	775	4,031
Tirunelveli ...	T	2,370	2,578	2,573	2,097	2,199	11,817
	R	1,483	1,583	1,723	1,291	1,329	7,409
	U	887	995	850	806	870	4,408
Kanyakumari ...	T	769	719	1,195	1,160	1,091	4,934
	R	604	593	979	907	835	3,918
	U	165	126	216	253	256	1,016
State ...	T	33,006	35,401	34,406	29,033	31,739	163,585
	R	20,120	21,387	21,353	16,943	19,439	99,242
	U	12,886	14,014	13,053	12,090	12,300	64,343

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO RESPIRATORY DISEASES, 1956–60

District	T/R/U	1956	1957	1958	1959	1960	1956–60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	8,087	9,219	8,803	9,087	8,718	43,914
	R	...	...	...	...	...	...
	U	8,087	9,219	8,803	9,087	8,718	43,914
Chingleput ...	T	3,275	3,177	2,796	2,640	2,989	14,877
	R	2,193	2,227	1,943	1,835	2,249	10,447
	U	1,082	950	853	805	740	4,430
North Arcot ...	T	3,916	4,645	4,383	3,772	4,140	20,856
	R	2,498	3,008	2,919	2,409	2,651	13,485
	U	1,418	1,637	1,464	1,363	1,489	7,371
South Arcot ...	T	2,621	2,841	2,336	2,702	2,511	13,011
	R	2,085	2,281	1,863	2,339	2,210	10,778
	U	536	560	473	363	301	2,233
Salem ...	T	2,774	2,838	2,955	2,851	2,857	14,275
	R	1,852	2,050	2,058	1,845	1,830	9,635
	U	922	788	897	1,006	1,027	4,640
Coimbatore ...	T	4,416	5,090	4,404	4,271	4,104	22,285
	R	2,812	3,089	2,661	2,533	2,692	13,787
	U	1,604	2,001	1,743	1,738	1,412	8,498
Nilgiris ...	T	743	761	672	682	621	3,479
	R	399	375	271	279	251	1,575
	U	344	386	401	403	370	1,904
Madurai ...	T	5,788	5,632	4,481	4,084	4,412	24,397
	R	3,082	3,143	2,497	2,281	2,747	13,750
	U	2,706	2,489	1,984	1,803	1,665	10,647
Tiruchirapalli ...	T	3,311	3,366	2,914	2,398	2,377	14,366
	R	2,397	2,280	2,116	1,773	1,811	10,377
	U	914	1,086	798	625	566	3,989
Thanjavur ...	T	2,192	2,191	2,127	1,885	1,764	10,159
	R	1,630	1,492	1,416	1,249	1,176	6,963
	U	562	699	711	636	588	3,196
Ramanathapuram ...	T	2,649	2,833	2,167	2,148	2,092	11,889
	R	1,865	1,946	1,573	1,633	1,574	8,591
	U	784	887	594	515	518	3,298
Tirunelveli ...	T	3,362	3,539	3,172	3,383	3,161	16,617
	R	1,818	2,044	1,889	2,006	1,725	9,482
	U	1,544	1,495	1,283	1,377	1,436	7,135
Kanyakumari ...	T	1,087	846	1,048	953	866	4,800
	R	881	603	813	728	624	3,649
	U	206	243	235	225	242	1,151
State ...	T	44,221	46,978	42,258	40,856	40,612	214,925
	R	23,512	24,538	22,019	20,910	21,540	112,519
	U	20,709	22,440	20,239	19,946	19,072	102,406

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO INJURIES, 1956-60

District		T/R/U	1956	1957	1958	1959	1960	1956-60
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras	...	T	495	573	506	503	398	2,475
		R	...	...	...	...	...	...
		U	495	573	506	503	398	2,475
Chingleput	...	T	281	296	307	335	349	1,568
		R	175	213	228	256	270	1,142
		U	106	83	79	79	79	426
North Arcot	...	T	722	735	750	730	678	3,615
		R	519	559	552	537	507	2,674
		U	203	176	198	193	171	941
South Arcot	...	T	496	464	395	433	509	2,297
		R	362	344	249	304	408	1,667
		U	134	120	146	129	101	630
Salem	...	T	717	827	904	866	879	4,193
		R	538	661	723	663	624	3,209
		U	179	166	181	203	255	984
Coimbatore	...	T	699	643	897	829	861	3,929
		R	503	359	585	544	563	2,554
		U	196	284	312	285	298	1,375
Nilgiris	...	T	78	72	61	73	60	344
		R	38	23	21	38	23	143
		U	40	49	40	35	37	201
Madurai	...	T	615	690	691	661	706	3,363
		R	362	413	472	384	467	2,098
		U	253	277	219	277	239	1,265
Tiruchirapalli	...	T	682	630	673	706	579	3,270
		R	551	526	561	578	469	2,685
		U	131	104	112	128	110	585
Thanjavur	...	T	586	567	734	695	664	3,246
		R	399	403	522	495	466	2,285
		U	187	164	212	200	198	961
Ramanathapuram	...	T	249	211	245	334	291	1,330
		R	180	151	169	232	201	933
		U	69	60	76	102	90	397
Tirunelveli	...	T	370	382	411	409	510	2,082
		R	217	240	263	244	300	1,264
		U	153	142	148	165	210	818
Kanyakumari	...	T	162	161	244	198	175	940
		R	113	132	205	157	134	741
		U	49	29	39	41	41	199
State	...	T	6,152	6,251	6,818	6,772	6,659	32,652
		R	3,957	4,024	4,550	4,432	4,432	21,395
		U	2,195	2,227	2,268	2,340	2,227	11,257

APPENDIX XIX—(*Contd.*)

DEATHS DUE TO ALL OTHER CAUSES, 1956-60

District	T/R/U	1956	1957	1958	1959	1960	1956-60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	16,663	18,239	17,140	17,326	17,879	87,247
	R	...	...	...	...	...	...
	U	16,663	18,239	17,140	17,326	17,879	87,247
Chingleput ...	T	21,221	20,225	20,508	18,381	18,131	98,466
	R	18,872	17,593	18,072	15,867	15,728	86,132
	U	2,349	2,632	2,436	2,514	2,403	12,334
North Arcot ...	T	26,722	29,546	28,263	24,689	26,294	135,514
	R	21,877	23,874	22,750	19,274	20,740	108,515
	U	4,845	5,672	5,513	5,415	5,554	26,999
South Arcot ...	T	25,445	25,356	19,880	20,920	23,052	114,653
	R	22,389	22,146	17,206	18,362	20,277	100,380
	U	3,056	3,210	2,674	2,558	2,775	14,273
Salem ...	T	21,779	23,502	22,639	21,217	20,960	110,097
	R	18,511	20,101	19,202	17,782	17,294	92,890
	U	3,268	3,401	3,437	3,435	3,666	17,207
Coimbatore ...	T	24,980	27,386	24,427	25,077	22,939	124,809
	R	18,789	20,385	18,143	18,424	16,388	92,129
	U	6,191	7,001	6,284	6,653	6,551	32,680
Nilgiris ...	T	1,806	1,691	1,603	1,853	1,597	8,550
	R	1,119	1,003	850	1,090	900	4,962
	U	687	688	753	763	697	3,588
Madurai ...	T	23,942	26,778	24,293	24,803	25,285	125,101
	R	15,752	18,026	16,340	16,066	16,872	83,056
	U	8,190	8,752	7,953	8,737	8,413	42,045
Tiruchirapalli ...	T	33,171	31,653	28,682	26,595	29,543	149,644
	R	27,048	25,548	23,213	21,004	24,068	120,881
	U	6,123	6,105	5,469	5,591	5,475	28,763
Thanjavur ...	T	37,436	34,943	34,886	28,458	29,475	165,198
	R	30,499	27,742	27,648	22,003	22,943	130,835
	U	6,937	7,201	7,238	6,455	6,532	34,363
Ramanathapuram ...	T	16,872	17,994	16,091	16,315	17,186	84,458
	R	12,144	12,962	11,608	11,860	12,774	61,348
	U	4,728	5,032	4,483	4,455	4,412	23,110
Tirunelveli ...	T	29,773	29,845	28,981	27,390	29,606	145,595
	R	22,067	22,481	21,844	20,659	22,273	109,324
	U	7,706	7,364	7,137	6,731	7,333	36,271
Kanyakumari ...	T	4,469	4,974	4,916	5,322	5,107	24,788
	R	2,876	3,595	3,442	3,638	3,480	17,031
	U	1,593	1,379	1,474	1,684	1,627	7,757
State ...	T	284,279	292,132	272,309	258,346	267,054	1,374,120
	R	211,943	215,456	200,318	186,029	193,737	1,007,483
	U	72,336	76,676	71,991	72,317	73,317	366,637

APPENDIX XIX—(*Contd.*)

TOTAL DEATHS FROM ALL CAUSES, 1956-60

District	T/R/U	1956	1957	1958	1959	1960	1956-60
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Madras ...	T	33,927	36,783	36,888	33,515	33,729	174,842
	R	...	...	...	...	...	...
	U	33,927	36,783	36,888	33,515	33,729	174,842
Chingleput ...	T	31,158	29,595	30,741	27,564	27,455	146,513
	R	26,433	24,635	26,237	23,036	23,128	123,469
	U	4,725	4,960	4,504	4,528	4,327	23,044
North Arcot ...	T	45,737	52,928	51,074	43,988	46,370	240,097
	R	37,414	43,081	41,296	34,788	36,849	193,428
	U	8,323	9,847	9,778	9,200	9,521	46,669
South Arcot ...	T	38,292	39,852	30,959	31,466	35,235	175,804
	R	33,581	34,778	26,656	27,692	31,242	153,949
	U	4,711	5,074	4,303	3,774	3,993	21,855
Salem ...	T	35,248	40,046	38,499	35,144	34,367	183,304
	R	29,549	34,031	32,542	29,158	28,127	153,407
	U	5,699	6,015	5,957	5,986	6,240	29,897
Coimbatore ...	T	38,020	42,025	37,888	37,713	34,655	190,301
	R	28,521	30,200	27,745	27,226	24,876	138,568
	U	9,499	11,825	10,143	10,487	9,779	51,733
Nilgiris ...	T	3,639	3,415	3,183	3,636	3,044	16,917
	R	2,400	2,143	1,838	2,230	1,768	10,379
	U	1,239	1,272	1,345	1,406	1,276	6,538
Madurai ...	T	38,316	42,759	38,014	37,090	39,064	195,243
	R	24,989	28,340	24,965	23,794	25,980	128,068
	U	13,327	14,419	13,049	13,296	13,084	67,175
Tiruchirapalli ...	T	48,116	46,999	41,591	36,964	40,509	214,179
	R	39,441	37,828	33,888	29,517	33,212	173,886
	U	8,675	9,171	7,703	7,447	7,297	40,293
Thanjavur ...	T	45,517	44,652	44,017	34,964	36,169	205,319
	R	36,702	35,055	34,239	26,619	27,798	160,413
	U	8,815	9,597	9,778	8,345	8,371	44,906
Ramanathapuram ...	T	29,101	30,426	26,116	26,159	27,358	139,160
	R	21,354	21,899	18,873	19,276	20,379	101,781
	U	7,747	8,527	7,243	6,883	6,979	37,379
Tirunelveli ...	T	41,375	43,233	41,050	38,104	41,432	205,194
	R	29,685	31,468	30,040	27,703	30,179	149,075
	U	11,690	11,765	11,010	10,401	11,253	56,119
Kanyakumari ...	T	8,195	8,109	9,301	9,442	9,074	44,121
	R	5,586	5,812	6,681	6,788	6,437	31,304
	U	2,609	2,297	2,620	2,654	2,637	12,817
State ...	T	436,641	460,822	429,321	395,749	408,461	2,130,994
	R	315,655	329,270	305,000	277,827	289,975	1,517,727
	U	120,986	131,552	124,321	117,922	118,486	613,267

APPENDIX XX

RECORDS RELATING TO EPIDEMIC DISEASES

According to the Board's Standing Order No. 102, on the occurrence of a case of cholera in a village, the Village Headman or Karnam should report the matter to the Tahsildar, Dy. Tahsildar and Health Inspector, and if the village is within five miles of a municipal town, he should report the matter to the Chairman of the Municipal Council. Besides these, he should maintain a register of attacks and deaths.

The reports referred to above should, so long as the epidemic lasts, be continued as daily reports in the prescribed forms.

The Register will be in the following form :

Register of Cholera/Small-pox/Plague/Relapsing fever/Malaria/Influenza in......................village during the year......

Sl. No.	Date of attack	Date of Report	Name of person attacked	Age	Sex		Residence	Date of death	Remarks
					Male	Female			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)

N.B.—A separate register must be maintained for each disease.

1. Daily Report of Epidemic

District :

Taluk :

Village :

Survey No. of the Village :

Population of the Village :

Name of the Epidemic :

Date of attack	Persons attacked		On the date of the Report				Upto the date of the Report				Date of death	Date of first death	Remarks
	Sl. No.	Name	No. of attacks		No. of deaths		No. of attacks		No. of deaths				
			Males	Females	Males	Females	Males	Females	Males	Females			
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)

2. **Daily Report of Cholera, Small-pox or the epidemic in the taluk of.................**

Village or Town	Survey No.	Population	Date	No. of attacks	No. of deaths	Number of: Attacks from beginning of outbreak*	Number of: Deaths from beginning of outbreak	Remarks as to steps taken etc.
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

In the case of cholera, every Health Officer should maintain in his office a detailed register showing the name of the town or village, name of inoculated person, residence, sex, age, date of exposure to infection, etc. From this register, a monthly consolidated statement in the accompanying form should be prepared and sent to the Director of Public Health, Madras.

Name of village	Population	Date of first case		Total number inoculated	Any case of death among inoculated	Remarks e.g. period between inoculation and	
		Attack	Death			Attack	Death
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)

Every Health Officer should also collect information regarding the treatment of cholera. A register in the following form should be maintained for this purpose.

Name of patient	Age, sex and residence	Date of attack	Date when treated	Condition at the time of treatment	Medicine given	No. of doses and quantity administered and results
(1)	(2)	(3)	(4)	(5)	(6)	(7)

APPENDIX XXI

REPORT ON THE ENQUIRY INTO THE INFANT MORTALITY IN POONAMALLEE HEALTH UNIT IN MADRAS STATE (1951-53)

The average infant mortality recorded in the composite State of Madras since 1902, the number of infant deaths in each year during 1941-51, and the infant mortality rates are extracted in the following table :—

TABLE I

Year		Average No. of infant deaths	Average infant mortality rate per 1,000 live births
(1)		(2)	(3)
1902—10	...	207,474	178.7
1911—20	...	232,608	189.0
1921—30	...	250,964	174.1
1931—40	...	295,611	177.0
1941—50	...	250,250	153.6
1941	...	293,462	170.9
1942	...	268,895	159.7
1943	...	269,744	172.3
1944	...	287,542	192.4
1945	...	256,176	169.4
1946	...	240,876	146.9
1947	...	251,461	146.8
1948	...	211,975	128.1
1949	...	204,730	119.8
1950	...	217,641	130.1
1951	...	186,286	118.6

An examination of Table I shows that nearly a quarter million infants die every year on the average and the infant mortality rate continues to be high as compared with advanced countries. The figures are, of course, subject to error due to incompleteness of registration of births and deaths. Even as it is, the quantum of waste of infant life is appalling. The infant mortality rates recorded during the last decade, however, reveal an appreciable fall. This decline cannot be satisfactorily explained in the absence of any special measure instituted for protecting thc health of the mother and the infant. It is, therefore, worthwhile to examine whether the low rates of 118.6 in 1951 and 108.6 in 1952 portray the true situation and to determine how best the fall in the rate, if real, could be reduced further by studying the causes of infant deaths.

In November 1950, proposals for an enquiry into the infant mortality in the Madras (composite) State were submitted to the Maternity and Child Welfare Advisory Committee of the Indian Council of Medical Research. The object of the investigation was mainly to assess the true infant mortality rate and the causes of infant mortality, based on personal enquiries by women medical officers and other qualified medical personnel in a representative cross-section of a population of 120,000 in five districts of the State. The Committee was of opinion that the estimated cost of the enquiry was high and that it was difficult to get trained personnel to work in rural areas. It was also of opinion that it would be better to confine the enquiry in a limited area instead of areas scattered far apart. It therefore recommended that a pilot enquiry may be conducted in conjunction with the Poonamallee Health Unit run by the State, as the personnel employed therein may be usefully utilised for the enquiry. The Governing Body of the Indian Council of Medical Research approved the investigation on the lines indicated above.

Object of the Enquiry

The infant mortality rates given in Table I are calculated on the conventional definition, *viz.*, the ratio of the number of infant deaths recorded in an area in a year to the number of live births recorded in the same area in the same year. Its accuracy depends on the completeness of registration of live births and infant deaths. It is well-known that registration of vital events in this State, although stated to be more accurate than in other States, is not complete. Secondly, the infant deaths are not referred to the same cohort of infants born during the period. It is therefore necessary to evaluate the correct infant mortality rate in this State. An attempt is made in this paper to assess with a greater degree of precision the infant mortality rate

in a rural area of this State. The method employed is detailed below.

The agency employed to register births and deaths in rural areas in this State are the village headmen who are not medical men. Moreover, medical certification of death is not compulsory. In this set-up, no useful information is available regarding the cause of infant deaths occurring in rural areas. So far, no attempt has been made in this State to ascertain the important causes of infant deaths that claim a heavy toll of infant life. A knowledge of the important causes of infant deaths is very necessary, if the maternal and child health measures are to be instituted on a scientific basis and directed economically. It was therefore proposed to ascertain the causes of infant deaths in the neo-natal period and the other age groups of infant life.

Scope of the Enquiry

One ideal method of securing the above results would be to observe a cohort of infants born during a certain period until they completed one year of life, in a medical institution staffed with trained medical personnel, and provided with laboratory, surgical and other facilities. The infants would constantly be kept under expert medical supervision. The cost of the scheme would be enormous. Besides this, the method suffers from the serious defect that the experience thus gained will not be representative of the rural life of infants in their homes and cannot truly reflect the field conditions in rural areas. An alternative method would be that a cohort of infants be observed daily in their own homes by medical personnel until the infants completed one year of life. Laboratory and other facilities should also be provided at convenient centres. This would entail the employment of a number of large medical personnel as the coverage should be wide and intensive to yield a fairly large sample. Here again, the cost of such an enquiry would be prohibitive.

It is realised that reliable information about the causes of infant deaths could be collected only, if facilities for autopsy, laboratory tests, etc., are available. These facilities are not available in view of the present financial conditions of the State. Instead of therefore resting on the oars helplessly until such time when funds will be made available for the purpose, it will be useful to collect information about infant deaths based on enquiry method employing qualified medical personnel. Such enquiries in similar fields of public health have yielded satisfactory results in western countries. It is conceded that the results may not be cent per cent accurate, but it will be the first step taken in the direction of assessing the causes of infant deaths. Keeping in mind the limitations attendant upon the enquiry method, the present investigation was sanctioned as a pilot enquiry. It was proposed to observe periodically the expectant mothers for a period of three months prior to confinement and the infants born to them for a period of one year in their own homes. The maternal and child health staff would visit the infants periodically, make enquiries and record their health conditions. If an infant died, the woman medical officer and the health visitor would specially visit the party and arrangements made to report it with the least practicable delay; and on intensive personal enquiry and examination of the health conditions already recorded at the previous visits, the cause of death was finally determined by the women medical officers. In other words, the data regarding cause of infant deaths were proposed to be collected by the enquiry method supported by previous records by maternal and child health staff. No autopsy was proposed to be done for obvious reasons.

Area selected for enquiry

In view of the well-established maternal and child health organisation in the Poonamallee Health Unit areas, the enquiry was conducted in that area. It is a typical rural area in Sriperumbudur taluk in Chingleput district, situated about 13 miles from Madras. The area comprises 36 revenue villages extending over 35 sq. miles with a population of 61,523 as per 1951 Census. The area was divided into six main divisions and a sub-division for purposes of maternal and child health services.

Period of enquiry

In order to assess the causes of infant deaths, it was considered that it would be useful to study the health conditions of the mothers from the twenty-eighth week of gestation. However, expectant mothers who came under the care of the maternity and child welfare staff at a state earlier or later than 28 weeks of gestation were taken on record and observed, as they could not be refused skilled aid from the administrative point of view. Expectant mothers registered in the maternal and child health centres of the Health Unit from 15th May 1951 to 14th May 1952, were observed for the purpose of the enquiry. Allowing a period of three months when the expectant mothers could be observed during their pregnancy, the infants born to these mothers during the period 15th August 1951 to 14th August 1952 were observed until they completed the first year of life or date of death. Hence, the enquiry commenced on 15th May 1951 and was continued upto 14th August, 1953, covering a total period of two years and three months.

Staff

The maternal and child health staff of the Health Unit consisted of one Woman Medical Officer, four Health Visitors, ten Midwives and necessary menial staff. This staff was augmented by one Woman Medical Officer (Assistant Research Officer) and two Health Visitors, employed out of the funds sanctioned for the enquiry by the Indian Council of Medical Research. There are six Maternal and Child Health Centres, one in each of the six main divisions of the Unit. The area was divided into two parts, each having one Woman Medical Officer, three Health Visitors and five Midwives. Each Woman Medical Officer was in charge of an area with a population of about 30,000, and each Health Visitor in charge of about 10,000. The whole maternal and child health staff was placed under the administrative control of the Health Officer of the Health Unit. As the Unit is situated close to the headquarters of the Public Health Department, the Assistant Director of Public Health Department, in charge of Maternity and Child Welfare, visited the Unit as frequently as possible, supervised and directed the work in connection with the enquiry.

Besides the maternity and child welfare staff of the Unit, there were midwives attached to other medical institutions in the area and there were also some dhais practising in the area. The permanent Woman Medical Officer of the Health Unit was not given any special training in paediatrics as she had already undergone the course in the Diploma in Maternity and Child Welfare. The Assistant Research Officer (the second Woman Medical Officer) was appointed on 15th May 1961. But she resigned within a month and another lady doctor was appointed. She was given necessary training under the Professor of Paediatrics, Madras Medical College, for a period of six weeks without prejudice to her work in respect of the enquiry. After serving for about six months, she also resigned. To avoid further changes in the post of the Assistant Research Officer, the services of the Woman Medical Officer, Salem District Board, were requisitioned. The changes did not however seriously affect the investigation.

There was no difficulty in appointing the two Health Visitors.

Plan of field work

The Health Visitor during her home visits was required to examine as far as possible every registered expectant mother once a month before confinement and to refer her immediately to the Woman Medical Officer, in case she required medical examination and treatment. The Woman Medical Officer was required to examine each mother once at least during her pregnancy and record her findings in the prescribed schedule. It was thus proposed that an expectant mother should ordinarily be examined at least four times during pregnancy by the Woman Medical Officer or Health Visitor. The observations made regarding the health of the mother at each visit were recorded in the schedule by the Woman Medical Officer or the Health Visitor as the case may be.

All particulars regarding the mother during labour and the infant at the time of birth were recorded soon after delivery in the schedule. The mother and the infant were thereafter generally attended to daily for a period of ten days after birth by the midwives. The Health Visitors were required to visit the infants twice during the neo-natal period. Thereafter, they were expected to visit the infants five times—once in the second and third months, and once during each of the subsequent quarters of the year. The Woman Medical Officer was expected to visit the infants once during the neo-natal period and once again thereafter. In respect of infant deaths, special visits were paid by the Health Visitors and the Women Medical Officers, as soon as possible after the event, to investigate the cause of death.

Schedule

A schedule to record the observations of the mother, the infant, their environment, economic status, history of previous confinements, conditions of the mother during pre-natal period and puerperium, conditions of the infant at birth and during the first year of life, was drawn up based on the form recommended in the memorandum of the Sub-Committee of the Indian Research Fund Association in 1949. Printed copies of the schedule were distributed to the maternal and child health staff for entering the observations then and there. Each schedule therefore gives the history of the mother and the infant—the mother's record from the date of registration to ten days after confinement, and the infant's record from the date of birth to the date of completion of one year or the date of death, whichever is earlier or the date when they left the Health Unit area.

A meeting of the Women Medical Officers and the Health Visitors was convened and clear instructions were given to them as to the method of filling in the particulars in the schedules and their maintenance. The Health Visitors were responsible for the maintenance of the records which were scrutinised by the Women Medical Officers.

Registration of Births and Deaths

Registration of births and deaths occurring in the Health Unit area is compulsory under the Madras Registration of Births and Deaths Act. Under this Act, the births should be registered within 14 days of the date of birth and the deaths within 7 days from the date of death. The Village Headmen are the Registrars of births and deaths. In order that information regarding the occurrence of infant deaths may reach the maternal and child health staff as expeditiously as possible, the Collector of the District at the request of this department, issued a circular to all the Village Headmen in the area to be more vigilant about registration of infant deaths and communicate the particulars about them to the concerned Women Medical Officers with the least practicable delay. Moreover, the Health Inspectors in the Health Unit area were also required to check up registration of births and deaths and notify infant deaths to the Woman Medical Officer promptly. This enabled the Woman Medical Officer to institute enquiries about the infant deaths as early as possible.

The enquiry

As mentioned above, it was proposed that the expectant mothers should be observed for three months prior to confinement in order that their history might throw more light on the causes of infant deaths. Hence the expectant mothers in the Health Unit area who were brought on record of the maternity and child welfare centres in the area during the period 15th May 1951 and 14th May 1952 were observed. They numbered 3,136. The infants born to these mothers during a period of one year from 15th August 1951 to 14th August 1952, only were proposed to be taken as the cohort of infants who would be observed and followed up till they completed one year. But some of these mothers left the area before confinement and never returned. Again, some mothers confined prior to 15th August 1951, or later than 14th August 1952. Excluding these expectant mothers, 1,725 mothers confined during the period 15th August 1951 to 14th August 1952.

Some of these mothers who were brought on record of the Centres and attended to during their ante-natal period by the maternity and child welfare staff, resorted to local dhais and other agencies for aid at confinement or went to hospitals outside the area for delivery. All these mothers and infants born to them were not followed up and in the few cases where the follow-up of infants was later undertaken, the particulars regarding mothers at confinement or infants immediately after confinement were not recorded. These mothers (175 in all) were therefore excluded. Hence, the 1,555 mothers who were brought on record, attended to at birth and followed up by the Maternal and Child Health staff of the Centres only were considered for the enquiry. A few mothers had to be hospitalised just at delivery owing to sudden complications. These mothers and their infants returned to the area and were followed up. The infants born to these 1,555 mothers only formed the cohort of infants and were observed during the enquiry.

For purposes of the analysis of data compiled in this enquiry, the number of mothers considered was 1,555. Of these, 8 mothers gave birth to twins; thus there were 1,563 infants in all. The number of live births was 1,506 (807 males and 699 females) and the number of still births was 57 (31 males and 26 females). The number of infants who formed the cohort for observation was therefore 1,506.

Economic Condition

In order to study the economic condition of the mothers, the monthly income of their husbands was recorded. The income was divided into 3 groups, *viz.*, those with a monthly income of less than Rs. 50, those with Rs. 50 and above but less than Rs. 100, and those with Rs. 100 and more. The distribution of mothers according to income is shown below :

Monthly Income		*No. of Mothers*	*Percentage to Total*
Less than Rs. 50	...	1,202	77.3
Rs. 50 and above but less than Rs. 100	...	278	17.9
Rs. 100 and more	...	75	4.8
		1,555	100.0

It will be seen from the above statement that most of them belonged to the poor income group. Their main occupation was agriculture and weaving and some were unskilled labourers.

Pre-natal Care

All the 1,555 mothers could not be observed for full three months prior to delivery, as any mother who sought the services of the maternity and child welfare centres at any period of gestation had to be registered and followed up.

Table II shows the periods for which the expectant mothers had pre-natal care by the maternal and child health staff.

TABLE II

Pre-natal care of Mothers

Period of pre-natal care		No. of expectant mothers
Less than 7 days	...	228
7 days and less than 14 days	...	50
14 days and less than 21 days	...	44
21 days and less than 30 days	...	60
1 month and less than 2 months	...	218
2 months and less than 3 months	...	250
3 months and over	...	705
Total	...	1,555

Out of 1,555 mothers, 324 or 21 per cent were not examined by the Women Medical Officers before delivery. Most of them were brought under the care of the maternal and child health staff nearly at full term as will be evident from Table II. Some of them entered the Maternity homes, just at the time of delivery. Moreover, the area under each Medical Officer was large and the population of over 30,000 was too unwieldy for intensive maternity and child welfare care. However, 223 of the 324 mothers not examined by the Women Medical Officers were visited by the Health Visitors and 82 out of the remaining 101 mothers were seen by the midwives. Only 19 or 1.2 per cent of the total number of mothers were not observed before delivery either by the Women Medical Officers or the Health Visitors or the Midwives. Table III shows the number of visits paid to the mothers by the staff according to the period of pre-natal care.

TABLE III

Number of health visits by period of pre-natal care

Period of pre-natal care		No. of expectant mothers	No. of visits by: Mid-wives	Health Visitors	Women Medical Officers
(1)		(2)	(3)	(4)	(5)
Less than One month	...	382	504	402	308
1—2 months	...	218	572	401	391
2—3 months	...	250	868	603	529
Over 3 months	...	705	3,467	2,463	2,474
Total	...	1,555	5,411	3,869	3,702

The number of visits by each category of staff increased with the inerease in pre-natal care. On an average an expectant mother had 2.4 visits by the Woman Medical Officer, 2.5 visits by the Health Visitor and 3.5 visits by the Midwife.

Age and parity of mothers

The following table shows the parity of mother correlated to her age. The mothers with live births only have been included in the table and 57 mothers with still born infants were excluded. The parity of 8 mothers who gave birth to twins was taken in respect of only one of the twins. Thus the table accounts for 1,498 mothers, although they had 1,506 live born infants.

TABLE IV

Age and Parity of Mothers

Parity of Mothers		Age of Mothers in years: 10—15	15—20	20—25	25—30	30—35	35—40	40—45	45—50	Not known	Total
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1	...	1	145	104	16	3	1	...	...	7	277
2	...	...	28	212	75	10	3	...	...	4	332
3	...	1	3	86	116	41	5	1	...	2	255
4	...	...	2	24	91	56	13	1	...	3	190
5	...	...	...	10	57	57	10	2	...	2	138
6	...	...	...	4	18	56	27	4	...	3	112
7	...	...	...	1	6	35	25	2	...	1	70
8	...	...	...	2	2	29	21	3	...	1	58
9	...	...	...	...	3	12	14	3	2	...	34
10 & above	...	...	...	...	1	...	20	10	1	...	32
Total	...	2	178	443	385	299	139	26	3	23	1,498

Table IV reveals that practically all children were born in the age period 15 to 45 years and the largest number of confinements occurred in the age group 20–25 years. The primi paras (277) constituted 18.5 per cent of the total number of mothers.

Infant mortality rate

The usual definition of infant mortality rate *viz.*, the ratio of the number of infant deaths in a year to the total number of live births in the same year, expressed per 1,000 of live births, is based on certain assumptions which may not be satisfied always. In adopting this definition, it is presumed that registration of births and infant deaths is cent per cent complete. Secondly, it is also presumed that the number of infant deaths among those born in the last year but occurring in this year will be counterbalanced by the infant deaths among those born in this year but occurring in the next year. This condition will not be satisfied if the live births fluctuate widely from year to year. As the infant mortality rates for the age groups under one week, one week to one month, one month to two months etc., vary greatly the numbers of infants in two successive years will vary much, if the births differ sharply from year to year and will not therefore counterbalance. This is explained clearly in the article " Effect of changing birth rates upon infant mortality rates," published in the Special Report of the United States Public Health Service, Volume 19, No. 21, dated 22nd March 1948. To obviate these defects, a cohort of infants born during the period of one year may be observed and followed up till all of them completed one year of life, so that the infant deaths occurring may be referred to the same cohort.

Although the procedure suggested above is simple, it is difficult in practice to follow up the infants till they complete one year as people move from place to place. The infants observed may be classified as follows : (*a*) infants followed up to one year of life, (*b*) infants followed up to their deaths before one year, and (*c*) infants lost to observation before they completed one year. The infants who have not been followed up may be assumed to be alive and the infant mortality rate based on the known deaths and the total births may be calculated. But this would be an under-estimate of the rate, as all the infants not followed up may not have survived one year. Moreover, the knowledge of the experience of infants so long as they were followed up is simply lost. The infant mortality rate in this enquiry is calculated by two methods explained below :

Method I

In the case where some infants fall out of observation at different periods within their first year of life it is possible to give a range of values for the infant mortality rate within which the true rate lies. Assuming that all the infants which were not completely followed up survived their first birth day, the infant mortality rate may be computed. This rate will give the lower limit of the range. On the other hand assuming that all the infants missed were dead, the infant mortality rate may be calculated. This will give the upper limit of the rate. The true infant mortality rate will be between these two extreme values. As it is not likely that all the infants who were not followed up till they completed one year would have died, the upper limit of the infant mortality rate will be exaggerated. The range will be wide. It can, however, be narrowed down a little, if we calculate the risk to life of the infants during the different age periods under one year and combine these experiences to reckon the range of the infant mortality rate. Suppose p_1 p_2 p_3 are the lower limits of probability to survive 24 hours, to survive seven days after having survived 24 hours, to survive one month after having survived seven days, to survive two months after having survived one month and so on, then the lower limit for surviving one year will be the product of these probabilities *viz.*, $p_1 \times p_2 \times p_3 \ldots\ldots\ldots\ldots p_{14}$. Similarly, if r_1 r_2 r_3 etc. are the upper limits of surviving the age periods mentioned above, the upper limit for surviving one year will be $r_1 \times r_2 \times r_3 \ldots r_{14}$. The lower and upper limits for not surviving one year *i.e.*, dying within a year will be $(1-p_1 \times p_2 \ldots p_{14})$ & $(1-r_1 \times p_2 \ldots p_{14})$. This method of determining a range has been applied to data compiled in the enquiry.

Table V sets forth the number of infants who were born between 15th August 1951 to 14th August 1952, the number of infants who died and the number of infants who fell out of observation before they completed the first year of life.

The figure in column (2) in each row gives the number of infants under observation at the beginning of the age period mentioned in column (1). The figures given in the same row under column (3) gives the number of known infant deaths during the age period and that given under column (4) gives the number of infants who dropped out of observation during the period. The maximum chances of surviving the age period are given in column (5) *e.g.*, the maximum number of infants surviving the age group 'under 7 days' is got by assuming that all the infants who fell out of observation during the age period survived. Hence the maximum chance of surviving the age group 'under 7 days' is equal to $1-\frac{36}{1,506}$ *i.e.*, 0.9761 given in column (5). Similarly, the maximum chance of surviving each age

TABLE V

Probability of Survival by age periods under alternative assumptions

Age Period	No. of infants observed at the beginning of the age period	No. of infants who died during the age period	No. of infants who were lost to observation during age period	Maximum chance of surviving the age period $1-\frac{\text{col. (3)}}{\text{col. (2)}}$	Minimum chance of surviving the age period $1-\frac{\text{cols. (3)+(4)}}{\text{col. (2)}}$
(1)	(2)	(3)	(4)	(5)	(6)
Within 7 days ...	1,506	36	8	0.9761	0.9718
7 days & less than 30 days ...	1,462	30	111	0.9795	0.9036
1—2 months ...	1,321	28	36	0.9788	0.9516
2—3 " ...	1,257	16	29	0.9873	0.9642
3—4 " ...	1,212	15	22	0.9876	0.9695
4—5 " ...	1,175	17	9	0.9855	0.9779
5—6 " ...	1,149	7	21	0.9939	0.9756
6—7 " ...	1,121	6	24	0.9946	0.9732
7—8 " ...	1,091	4	26	0.9963	0.9762
8—9 " ...	1,061	7	19	0.9934	0.9755
9—10 " ...	1,035	7	33	0.9932	0.9614
10—11 " ...	995	7	...	0.9930	0.9930
11—12 " ...	988	6	...	0.9939	0.9939
1 Year ...	...	...	...	0.86241	0.65532

group is calculated and given in column (5) against each age group.

The minimum number of infants surviving the age group 'under 7 days' is got by assuming that all infants who fell out of observation during the age period died. Hence the minimum chance of surviving the age group 'under 7 days' is equal to $1-\frac{36+8}{1,506}$ *i.e.*, 0.9718 given in column (6). Similarly the minimum chance of surviving each age group is computed and given in column (6) against each age group.

The maximum probability of surviving one year of life is got by multiplying all the figures in column (5) and the minimum probability by multiplying all the figures in column (6) *i.e.*,

Maximum probability of surviving = 0.86241

Minimum probability of surviving = 0.65532

The minimum chance of dying within the first year is 1 — 0.86241 = 0.13759. In other words, the lower limit of infant mortality rate is 137.59 per 1,000 live births. The maximum chance of dying within the first year is 1—0.65532 or 0.34468 *i.e.*, the upper limit of infant mortality rate is 344.68 per 1,000 live births. The true infant mortality therefore lies between 137.59 and 344.68 per 1,000 live births. This is a very wide range as pointed out above.

Method II

In this method, the knowledge of the experience of infants who were followed up for one year is utilised in a different manner and a single value for the infant mortality rate is arrived at. This will yield a more accurate approximation to the true infant mortality rate. The infant mortality rate arrived at by this method will lie between the lower and the upper limits of infant mortality rate calculated in the previous

method, except in the special case when all the infants were followed up right through one year of their life. If n is the number of infants in a cohort, d, the number of known infant deaths and x, the number of infants who could not be followed up, the infant mortality rate reckoned on the number of known deaths referred to the number of infants followed up will be equal to $\frac{d}{n-x}$.

The lower and upper limits of infant mortality rates as per the previous method will be equal to

$$\frac{d}{n} \text{ and } \frac{d+x}{n}.$$

It can be proved algebraically that the value

$$\frac{d}{n-x}$$

will be between $\frac{d}{n}$ and $\frac{d+x}{n}$ unless x, the number lost to observation is zero, when all the three ratios will be equal, as they ought to be.

In this method, it is assumed on *a priori* grounds, that the infants who left the area experienced the same mortality rate as those who were followed up, other things remaining equal *i.e.*, the probability of an infant who was not followed up dying in a certain age period is the same as the probability of an infant who was followed up and died in the same age period. For example, suppose, there are 100 infants in the age group one to two months and 20 of these were not followed throughout the age period and 8 out of the remaining who were observed are known to have died, giving a mortality rate of 8/80 × 1,000 or 100 per 1,000 live births. It is presumed that the infant mortality rate among the 20 infants will also be equal to 100 per 1,000 live births *i.e.*, two out of 20 infants would die. It is reasonable to make this assumption, unless there is reason to believe that only 'picked' infants were lost to observation. The infants that could not be followed up were not a selected group. Most of these mothers were only temporary residents and left the area in the usual course of events.

Table VI gives the particulars necessary for calculating the infant mortality rate by this method.

TABLE VI

Estimated Number of Survivors among infants followed up

Age Period	No. of infants observed at the beginning of the age period	No. of infants who died during the age period	No. of infants who left the area during the age period	Ratio of infant deaths to No. of infants followed up $\frac{\text{Col. (3)}}{\text{Col. (2)—(4)}}$	No. of infants at the beginning of the age group	No. of infant deaths in each age group Col. (5)×Col.(6)
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Within 7 days ...	1,506	36	8	0.024032	100,000	2,402.2
7 days and less than 1 month	1,462	30	111	0.022206	97,596.8	2,167.2
1—2 months ...	1,321	28	36	0.021790	95,429.6	2,079.4
2—3 " ...	1,257	16	29	0.013029	93,350.2	1,216.3
3—4 " ...	1,212	15	22	0.012605	92,134.9	1,161.4
4—5 " ...	1,175	17	9	0.014580	90,973.5	1,326.4
5—6 " ...	1,149	7	21	0.006206	89,647.1	556.3
6—7 " ...	1,121	6	24	0.005469	89,090.8	487.2
7—8 " ...	1,091	4	26	0.003756	88,603.6	332.8
8—9 " ...	1,061	7	19	0.006718	88,270.8	593.0
9—10 " ...	1,025	7	33	0.007035	87,677.8	612.5
10—11 " ...	995	7	...	0.007035	87,065.3	612.5
11—12 " ...	998	6	...	0.006073	86,452.8	525.0
					85,927.8	

The probability of an infant dying based on known infant deaths and the infants followed up in each age group is given in column (5). Assuming this measure of risk of dying in each age group, a cohort of 100,000 infants may be followed up as in computing a life table *e.g.*, the number of infant deaths in the age group 'under 7 days' is got by multiplying the probability of 0.024,032 and 100,000 the number of infants at the beginning of the age periods, *i.e.*, 2,403.2 and is entered in column (7). The number of infants surviving seven days is given under column (6) in the second row *i.e.*, 100,000—2,403.2=97,596.8. The number of infants among those who die in the age group '7 days to 30 days' as per the probability of dying given in column (5) is given in column (7) and so on.

The number of infants who survived one year is given at the bottom of column (6) *viz.*, 85,927.8. Out of 100,000 infants followed up for one year, 14,092.2 infants died. The infant mortality rate is therefore 140.92 per 1,000 live births.

The rates in the age periods under one year may be easily computed from column (6) of Table VI. They are extracted below :

TABLE VII

Infant mortality rate by Age Periods

Age periods		*Infant mortality rate per 1,000 live births*
Under 1 month	...	45.70
One month and under 6 months	...	63.39
Six months and under 12 months	...	31.83
Under one year	...	140.92

The infant mortality rate for the composite Madras State for 1952 is 108.2 and the rate for the Health Unit area for 1952 is 120.5. These rates are calculated on the basis of the definition adopted by convention and are low when compared to the rates arrived at by following a cohort of infants.

The neo-natal mortality rate is 45.70 per 1,000 live births and represents 32.4 per cent of the total infant mortality rates, whereas the neo-natal mortality in the composite State is 50 and 49 per cent of the total infant mortality in 1951 and 1952. The low contribution of neo-natal mortality as compared with the rural areas in the State is perhaps partly due to the intensive maternity and child welfare services in the area.

Cause of infant deaths

In the paragraphs under scope of enquiry and plan of field work, the method of compiling particulars regarding causes of infant deaths has been detailed at length. The infants coming under the enquiry were periodically visited by the Health Visitors and the Women Medical Officers, and their health conditions at the time of visit and since the last visit were carefully recorded. Table VIII shows the periods for which infants were followed and the number of visits paid by the Health Visitors and the Women Medical Officers.

TABLE VIII

Number of health visits according to the period of follow up of infants

Periods for which infants were followed up		No. of infants	No. of visits paid by the Health Visitors	No. of visits paid by the Women Medical Officers
(1)		(2)	(3)	(4)
Under 1 month	...	180	100	56
1—3 months	...	108	267	105
3—6 „	...	91	328	111
6—9 „	...	86	479	153
9—12 „	...	1,041	7,102	3,275
Total	...	1,506	8,276	3,700

On an average, an infant was visited 2.5 times by the Woman Medical Officer and 5.5 times by the Health Visitors. The longer the period of follow-up, the number of visits paid were greater.

In the case of every infant death, the Women Medical Officers visited specially the parties concerned with the least practicable delay. Out of 186 infant deaths, 56 were enquired into within 7 days, 27 within 8 to 14 days, 29 within 15 to 30 days, and 28 after one month. In respect of 46 deaths, the date of visit by the staff has not been entered. Although every attempt was made to ensure that all infant deaths were promptly reported to the Women Medical Officers, some cases were reported late. In a few instances, the parties left the area immediately after death and returned later to the area with the result that enquiries could be instituted at a late stage. The causes of majority of infant deaths were investigated within a fortnight of the date of death.

The Women Medical Officers made detailed enquiries with the record of the previous history of the infant and decided the cause of death. The causes of infant deaths are classified as per the list in Appendix II to the memorandum on the Conduct of an Enquiry into Infant Mortality prepared on the basis of the International List by the Sub-committee of the Maternity and Child Welfare Advisory Committee of the Indian Research Fund Association in 1949. Table IX shows the distribution of infant deaths as per causes and ages.

TABLE IX

Cause of Deaths by age periods

Causes	Age of infant deaths							
	Less than 24 hours	One day and less than seven days	Seven days and less than one month	1—3 months	3—6 months	6—9 months	9—12 months	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dyspepsia	...	...	1	...	3	...	...	4
Infantile cholera	...	...	1	2	1	...	1	5
Intestinal Intoxication	...	...	2	8	16	7	9	42
Measles	...	...	1	...	...	1	...	2
Small-pox	...	...	...	...	1	...	...	1
Whooping cough	...	...	...	3	...	...	...	3
Dysentery	...	...	...	2	1	2	4	9
Influenza	...	...	...	...	3	...	...	3
Septicaemia	...	...	...	...	1	...	...	1
Pyogenic Infection-(Skin)	...	...	1	6	2	1	3	13
Other skin diseases	...	...	...	1	...	...	...	1
Bronchitis	...	...	3	5	2	1	3	14
Bronchial pneumonia	...	...	...	1	...	...	...	1
Pneumonia	...	...	...	1	2	...	...	3
Infective hepatitis	...	...	...	1	...	...	...	1
Spina Bifida and Meningocele	...	...	...	1	...	...	...	1
Imperforate Anus	...	2	1	...	...	...	...	3
Congenital Malformation of Digestive system								
Exomphalos	1	...	...	...	...	...	...	1
Birth Injury	1	...	...	...	...	...	...	1
Asphyxia	6	11	4	3	...	2	...	26

TABLE IX—(*Contd.*)

Cause of Deaths by age periods—(*Contd.*)

Causes	Age of infant deaths							
	Less than 24 hours	One day and less than seven days	Seven days and less than one month	1—3 months	3—6 months	6—9 months	9—12 months	Total
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pneumonia of new born	...	...	2	...	...	...	...	2
Diarrhoea of new born	...	1	2	3	1	...	...	7
Pemphigus neonatorum	...	...	1	...	...	...	...	1
Neo-natal disorders arising from Maternal Toxaemia	...	1	...	...	...	...	...	1
Prematurity	4	6	6	5	1	1	...	23
Haemorrhagic diseases of new born	...	2	1	...	...	...	...	3
Nutritional Maladjustment	...	...	3	2	3	2	...	10
Accident	...	...	...	...	1	...	...	1
Unknown	...	1	1	...	1	...	...	3
Total ...	12	24	30	44	39	17	20	186

An examination of the table reveals the following salient features :

(i) Intestinal intoxication caused the largest number of infant deaths (42), representing 22.6 per cent of infant deaths. 32 of these deaths *i.e.*, 74 per cent occurred between 3–12 months.

(ii) Asphyxia was the next cause which claimed 26 infant deaths *i.e.*, 14 per cent of the total infant deaths. Of these 26 infants, 21 died within the first month of life.

(iii) The third cause in importance is prematurity which was responsible for 23 deaths, or 12.4 per cent of total infant deaths. Most of the deaths due to this cause occurred in the neo-natal period. Except in the case of two infants for whom birth weight was not recorded, the birth weight was 5½ pounds and less. In the only one case where the infant weighed 5½ lbs. and was born at full term, showed signs of immaturity. Twelve of these infants were born with a period of gestation of 37 weeks and less and the other eleven at full term.

(iv) Bronchitis, Pyogenic Infection (Skin) Nutritional Maladjustment caused 14, 13 and 10 infant deaths representing 7.5, 7.0 and 5.4 per cent of total infant deaths respectively.

(v) Out of 66 neo-natal deaths, 26 were caused by Asphyxia and 16 by prematurity.

(vi) In only 3 cases of infant deaths *i.e.*, 1.6 per cent, the causes of deaths could not be decided.

Prematurity

The expert group on prematurity of the World Health Organisation has recommended the adoption of the following definition of premature birth for purposes of vital statistics (vide Technical Report Series 27 of the World Health Organisation).

"for purposes of this classification, an immature infant is a live-born infant with a birth-weight of 5½ pounds (2,500 grams) or less, or specified

as immature. In some countries, however, this criterion will not be applicable. If weight is not specified, a live-born infant with a period of gestation of less than 37 weeks or specified as 'Premature' may be considered as the equivalent of an immature infant for purposes of this classification."

The term 'immature' and 'premature' are stated to have been used interchangeably. The Expert Group however prefers the term 'premature' to the term 'immature'.

The Group has stated that the criterion of birth weight will not be applicable in some countries. The reasons for this have not been stated. In order to see whether the term of birth weight of 5½ lbs. and less will apply to the conditions in this State, it was proposed that the weights of infants at birth should be recorded. The midwives were, therefore, provided with spring balances normally used for weighing infants. As the supply of balances was a little delayed, all the infants were not weighed. The weights of 1,366 out of 1,506 live-born infants were recorded. The distribution of infants as per birth weights is shown below :

TABLE X

Frequency distribution of Infant by Birth Weight

Birth weight in lbs.	*No. of Infants (Live Born)*
1½ to 2 lbs.	1
2 to 2½ lbs.	1
2½ to 3 lbs.	5
3 to 3½ lbs.	14
3½ to 4 lbs.	20
4 to 4½ lbs.	105
4½ to 5 lbs.	27
5 to 5½ lbs.	144
5½ to 6 lbs.	464
6 to 6½ lbs.	310
6½ to 7 lbs.	149
7 to 7½ lbs.	74
7½ to 8 lbs.	34
8 to 8½ lbs.	14
8½ to 9 lbs.	3
9 to 9½ lbs.	1
Total	1,366

The average birth weight of the infants worked out from the above distribution is 5 lbs. and 15 ozs. which is a little above the norm given in the International definition for premature births, suggesting the applicability of the definition to this State. Hence adopting the International definition, it was found that 317 out of 1,366 live born infants for whom weights were recorded, weighed 5½ pounds and less. The incidence of premature births judged by this standard works out to 23.2 per cent. This rate may be compared with the percentage of 17.6 in the enquiry into the bearing of premature and immature births of Infant Mortality in Bombay Municipality 1946–48 by Dr. B. C. Das Gupta, and 4.5 in England and Wales in 1945—Ministry of Health Report, 1947. The incidence of premature births recorded in the present enquiry is very high.

The period of gestation calculated from the date of commencement of last menstruation to the date of birth, could not be recorded accurately as the mothers did not maintain records of the actual date of last menstruation. Hence, the period of gestation as judged by the maternity and child health staff at birth was recorded. Adopting the period of gestation of less than 37 weeks for determining prematurity, the incidence of premature births was only 5.1 per cent, 77 out of 1,506 infants being born with a period of gestation of 37 weeks or less. The large variation in the incidence of prematurity arrived at by adopting the two criteria shows that either the estimate of period of gestation was wrong or that criterion of birth weights is a better yardstick to measure prematurity.

Still Births

There were 57 still births out of 1,563 infants who came under observation, giving a rate of 36.5 per 1,000 live and still births. This is very high when compared to the rate of 5.0 and 4.7 for the rural areas in the composite State of Madras in 1951 and 1952 respectively. The large difference shows the gross defect in the registration of still births.

Out of 57 still births, the weights of 37 only were recorded. The birth weight of 23 out of 37 still births was 5½ pounds and less, representing a percentage of 62.6. The period of gestation was less than 37 weeks in the case of 19 still births or 33.3 per cent of total still births.

The distribution of still births as per parity was as follows :—

TABLE XI

Still Births by Parity

Parity	*No. of Still Births*
1	17
2	14
3	6
4	5
5	2
6	4
7	2
8	3
9	2
11	2
Total	57

About 30 per cent of still births were primi paras.

Discussion

The present enquiry to assess the correct rate and cause of infant mortality by maternity and child health staff in a rural area extending over 35 sq. miles with a population of over 60,000 was undertaken purely as a pilot enquiry. The enquiry method adopted for compiling particulars in this regard under the intimations attendant upon such method has furnished information on the subject which is more reliable than the personal opinions held by different medical men.

In a field enquiry of this type, the co-operation of the people is very essential. In the present enquiry, such co-operation was forthcoming to some extent. No opposition was experienced. To secure this measure of co-operation, the Women Medical Officers had to give medical treatment to mothers and their children as far as possible, give expert obstetrical care wherever necessary and inspect school children. They paid home visits and carried out health education besides other routine duties incidental to administration. It was therefore found difficult to carry on the intensive investigation into infant mortality and at the same time run practically the maternity and child welfare centres with the sanctioned staff of a Woman Medical Officer for a population of 30,000, a Health Visitor for 10,000 and a Maternity Assistant for 6,000.

The infant deaths were generally brought to the notice of Women Medical Officers a week after the death in spite of every care taken for early reporting of the infant deaths except in a few cases. The following factors were responsible for delayed tracing of infant deaths: (*a*) Ignorance and superstition still persists. People believe that witch-craft and mendicants can cure illness and they resort to their help rather than that of medical men. For instance, several cases of diarrhoea were brought to the Women Medical Officers only long after the spiritual treatment with the result that infants were almost in a dying state with exhaustion, dehydration and toxicity when little relief could be afforded. (*b*) Secondly, the medical facilities afforded to mothers who came to the centres were meagre with the result that the mothers sought hospitalisation outside the area with a sense of frustration. (*c*) In a few cases the people are so poor that they leave the infants without any treatment leaving them to their destiny.

Summary

In the present enquiry 1,555 expectant mothers were observed. They gave birth to 1,563 infants (838 males and 725 females) including 8 twins. Of these 1,506 live born infants, 186 were known to have died. The findings in the enquiry are as follows :

(1) The range within which the infant mortality rate for the period under enquiry—August 1951 to August 1952—lay between 137.59 and 344.68 per 1,000 live births. The true infant mortality was found to be 140.92 per 1,000 live births. The infant mortality rates in the age groups under one year were as follows :

Under one month	...	45.70 per 1,000 live births
1—6 months	...	63.39 „
6—12 months	...	31.83 „
		140.92

(2) The most important causes of infant deaths were as follows :

Causes of deaths	No. of infant deaths	Percentage to total infant deaths
(1)	(2)	(3)
1. Intestinal intoxication ...	42	22.6
2. Asphyxia ...	26	14.0
3. Prematurity ...	23	12.4
4. Bronchitis ...	14	7.5
5. Pyogenic Infection (skin) ...	13	7.0
6. Nutritional mal-adjustment ...	10	5.4

(3) The incidence of prematurity was 23.2 per cent as against 4.5 in England and Wales in 1945.

(4) The still birth rate was 36.5 per 1,000 live and still births, as against 4.7 for rural areas in Madras State in 1952. This reveals the defective registration of still births in the State. About 30 per cent of these occurred in the primi paras. Based on birth weights, 62.6 per cent were premature.

APPENDIX XXII

RECONSTRUCTION OF THE AGE DATA AND THE COMPUTATION OF SURVIVAL RATIOS

1. Adjustment of age data for India and Madras

Data on age are the basic material required for the estimation of migration by the Survival Ratio Method. Information on age has been elicited in every Indian Census, but the definition of age has not been uniform throughout: Table I gives a synoptic view of the age data available in Indian Censuses. Prior to 1951 Census, India included Pakistan and upto 1931 Census, it included Burma as well. The subsequent territorial changes call for considerable adjustment and caution in the use of the age data from Indian Censuses.

In the present study, two sets of estimates of migration are attempted. In the first series, the net migration from Madras State to the rest of India including Pakistan and Burma for the decades 1901–11, 1911–21 and 1921–31 has been attempted. This required the age data for India including Pakistan and Burma. Mr. K. C. Zachariah has presented the graduated age data for 1901 to 1931 in respect of India including Pakistan and Burma. These figures were adopted for the estimation of migration in the first series.

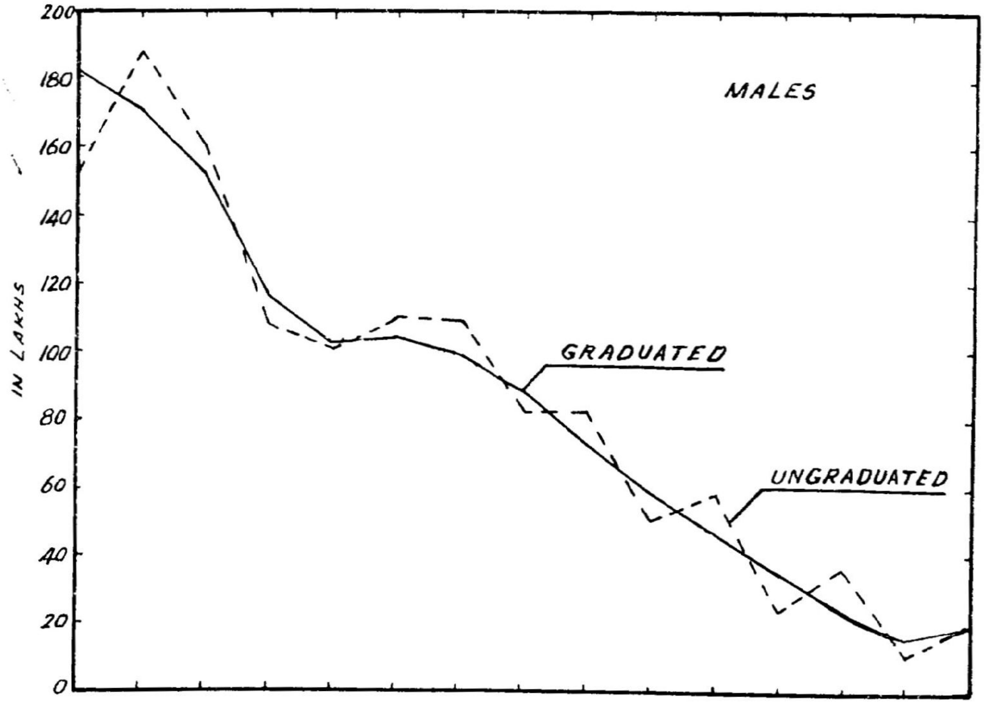
TABLE I

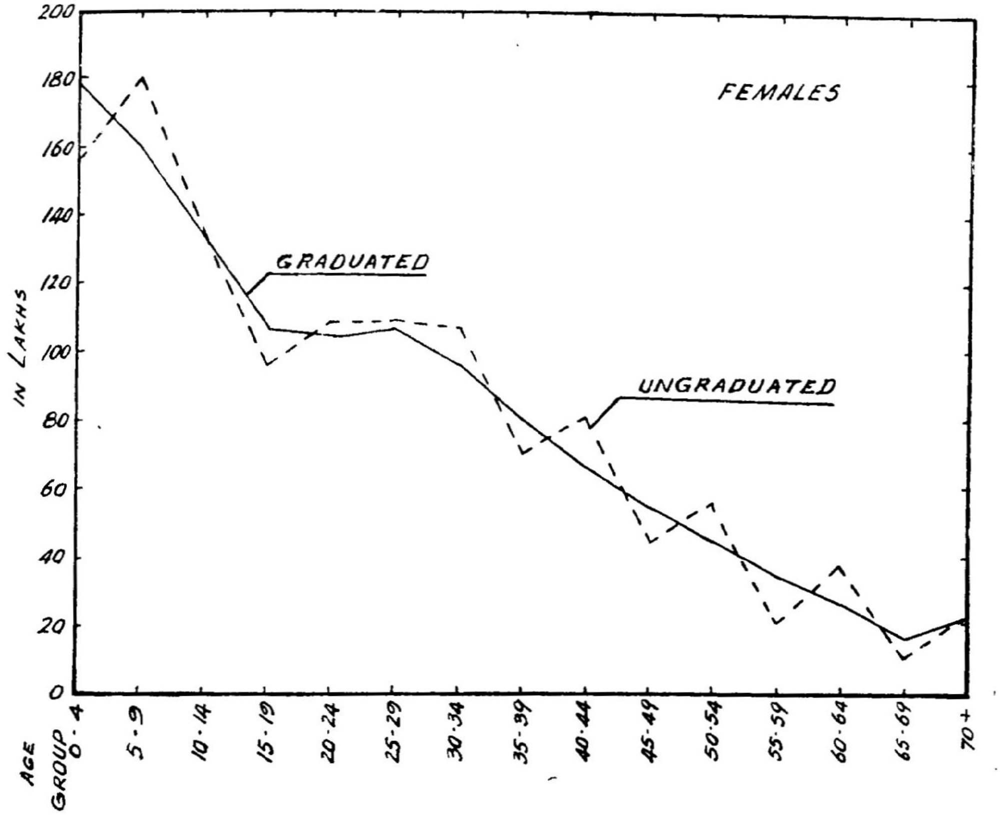
Age Data in Madras Censuses, 1872–1961

Census Year	Question No.	Nature of Definition	Where available	Remarks
1872 ...	11	Completed years	...	
1881 ...	5	Do.	... Table-VII ...	
1891 ...	7	Do.	... Table-VII & Table-VIII ...	Part A to K of Table-VII gives Age by Religion. Part A to L of Table-VIII gives Civil Condition by Age and Religion.
1901 ...	7	Do.	... Table-VII ...	Part-I contains statistics for every religion, Part-II deals with the towns of the Former Presidency treated as Cities.
1911 ...	7	Do.	... Table-VII ...	Do.
1921 ...	7	Do.	... Table-VII Part-II Imperial Tables.	The table is divided into two parts. Part-I begins with a provisional summary wherein statistics of every religion returned are given. Part-II deals with the towns treated as "Cities", the City of Madras being excluded since its figures are included in Part-I. In the provincial summary, details are given for each age upto five years of age; thereafter ages are grouped by quinquennial periods upto 70 and the remainder shown as 70 and over. In Part-I (Districts and States) and in Part-II (Cities), age periods are given in less detail than in the provincial summary. No single year age data are available.
1931 ...	7	Age nearest birthday	... Table-VII, Part-II Imperial Tables.	Do.
1941 ...	6	Completed Years	... Census of India Paper No. 8, 1951 Age Table for Madras—Y-sample.	Estimated from Y sample (2%). No single year age data are available.
1951 ...	4	Completed Years	... C-V of Part-II-B and Census of India Paper No. 3, 1954.	Single year age returns available for districts based on 10% sample. Graduated age data for composite Madras State are available in the Census Paper.
1961 ...	2	Completed Years	... C-IV of Part-II-B ...	Single year age returns are available for the entire population.

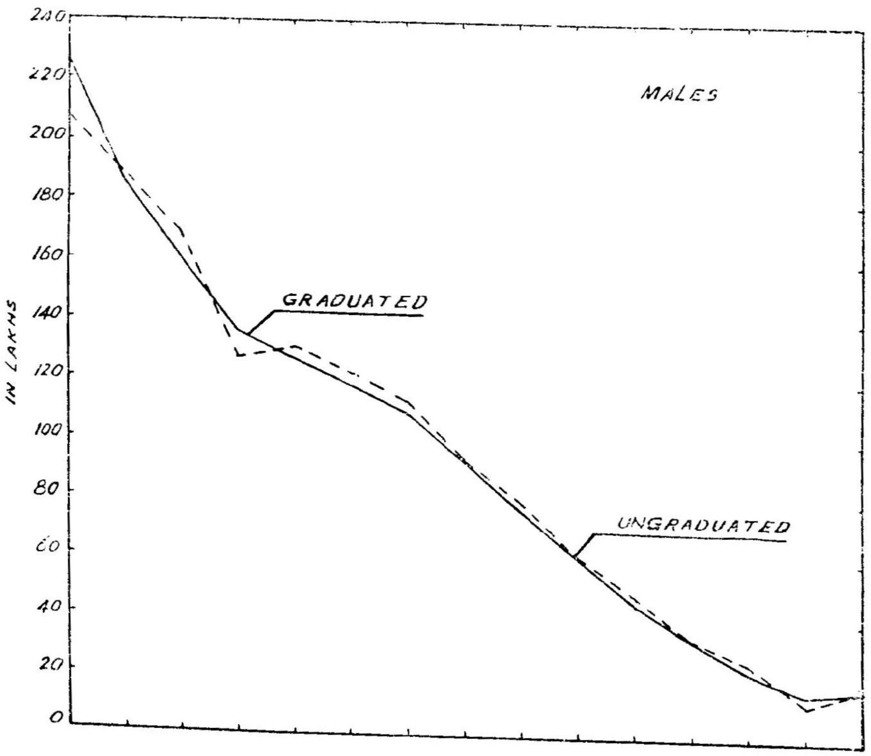
For the second series we need data on the age-sex distribution of India as constituted now. This was done by adding the age data for the States which cover the present Indian States and then pro-rating them as per the population of India in A-II Table of Part II-A Volume. The age distribution for 1941 was constructed on the basis of the Y-Sample (2% sample) available for about 93.5% of the population. For 1951, we have a 10% sample population classified by age and sex. In all cases pro-rating was done separately for males and females. For 1961, age-sex distribution is available for the entire population and they are adopted as such. The raw age-sex distribution for India for 1921 to 1961 are presented in Table II.

GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR INDIA, 1921
AFTER PRO-RATING





GRADUATEL & UNGRADUATED AGE DISTRIBUTION FOR INDIA, 1931
AFTER PRO-RATING



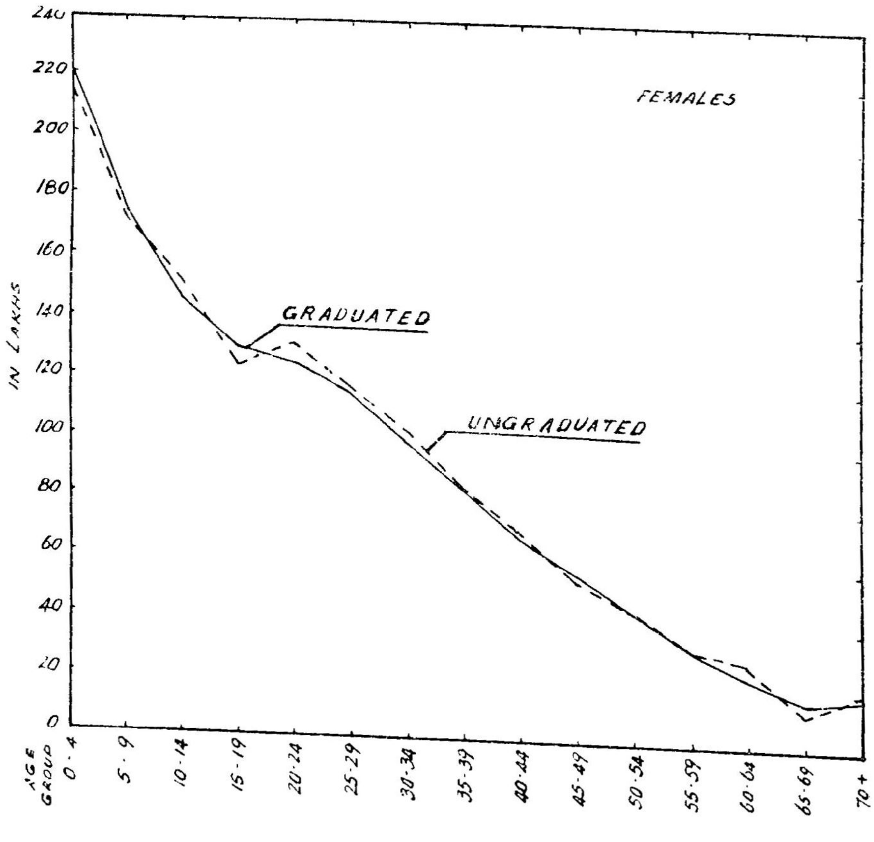


TABLE II

Ungraduated age data for India, 1921–61*

Age Group	1921		1931		1941		1951		1961	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0—4 ...	15,218,000	15,795,000	20,872,000	21,423,000	21,590,000	21,792,000	24,281,000	24,061,000	33,165,000	32,903,000
5—9 ...	18,743,000	18,091,000	18,713,000	17,179,000	22,988,000	21,801,000	23,304,000	22,527,000	33,044,000	31,568,000
10—14 ...	16,055,000	13,323,000	17,076,000	15,113,000	19,343,000	16,502,000	23,027,000	20,927,000	26,245,000	23,001,000
15—19 ...	10,719,000	9,558,000	12,734,000	12,499,000	13,777,000	12,659,000	16,909,000	15,899,000	18,575,000	17,261,000
20—24 ...	9,911,000	10,687,000	12,889,000	13,200,000	12,897,000	13,296,000	14,915,000	15,255,000	18,172,000	19,112,000
25—29 ...	11,086,000	10,834,000	12,206,000	11,820,000	13,829,000	13,590,000	15,290,000	14,545,000	18,511,000	18,030,000
30—34 ...	10,728,000	10,494,000	11,239,000	10,376,000	12,427,000	11,794,000	13,571,000	12,966,000	15,970,000	14,837,000
35—39 ...	8,191,000	7,096,000	9,252,000	8,268,000	10,633,000	9,530,000	11,907,000	10,399,000	13,590,000	11,845,000
40—44 ...	8,169,000	7,897,000	7,927,000	7,038,000	9,365,000	8,620,000	10,852,000	9,749,000	12,074,000	10,757,000
45—49 ...	5,061,000	4,307,000	6,177,000	5,413,000	7,460,000	6,444,000	8,452,000	7,228,000	9,727,000	8,310,000
50—54 ...	5,759,000	5,583,000	4,861,000	4,398,000	6,757,000	6,205,000	7,778,000	7,078,000	9,122,000	7,966,000
55—59 ...	2,381,000	2,072,000	3,343,000	3,233,000	3,979,000	3,484,000	4,773,000	4,090,000	5,277,000	4,540,000
60—64 ...	3,491,000	3,829,000	2,644,000	2,701,000	3,712,000	3,725,000	4,608,000	4,790,000	5,701,000	5,521,000
65—69 ...	1,017,000	978,000	1,252,000	1,261,000	2,193,000	2,250,000	2,213,000	2,169,000	2,469,000	2,374,000
70+ ...	2,017,000	2,231,000	1,745,000	1,862,000	2,735,000	2,998,000	3,648,000	3,877,000	4,171,000	4,434,000
All Ages ...	128,546,000	122,775,000	142,930,000	135,789,000	163,685,000	154,690,000	185,528,000	175,560,000	225,813,000	212,459,000

* Adjusted to the present boundaries. The figures under ' age not stated ' have been pro-rated.

Madras State has undergone considerable territorial changes during the last decade and the need for reconstructing the age data to the present boundaries of the State bristled with considerable difficulties. Our approach was to reconstruct the age tables for all the districts other than the Kanyakumari district and then obtaining the age distribution for the whole State by pro-rating. Except for 1941, 1951 and 1961 for which age data are available by single years of age (for 1941 and 1951 in respect of a sample population and for 1961 in respect of the entire population), we had the difficulty of building up the age-sex distribution by 5 year age groups.

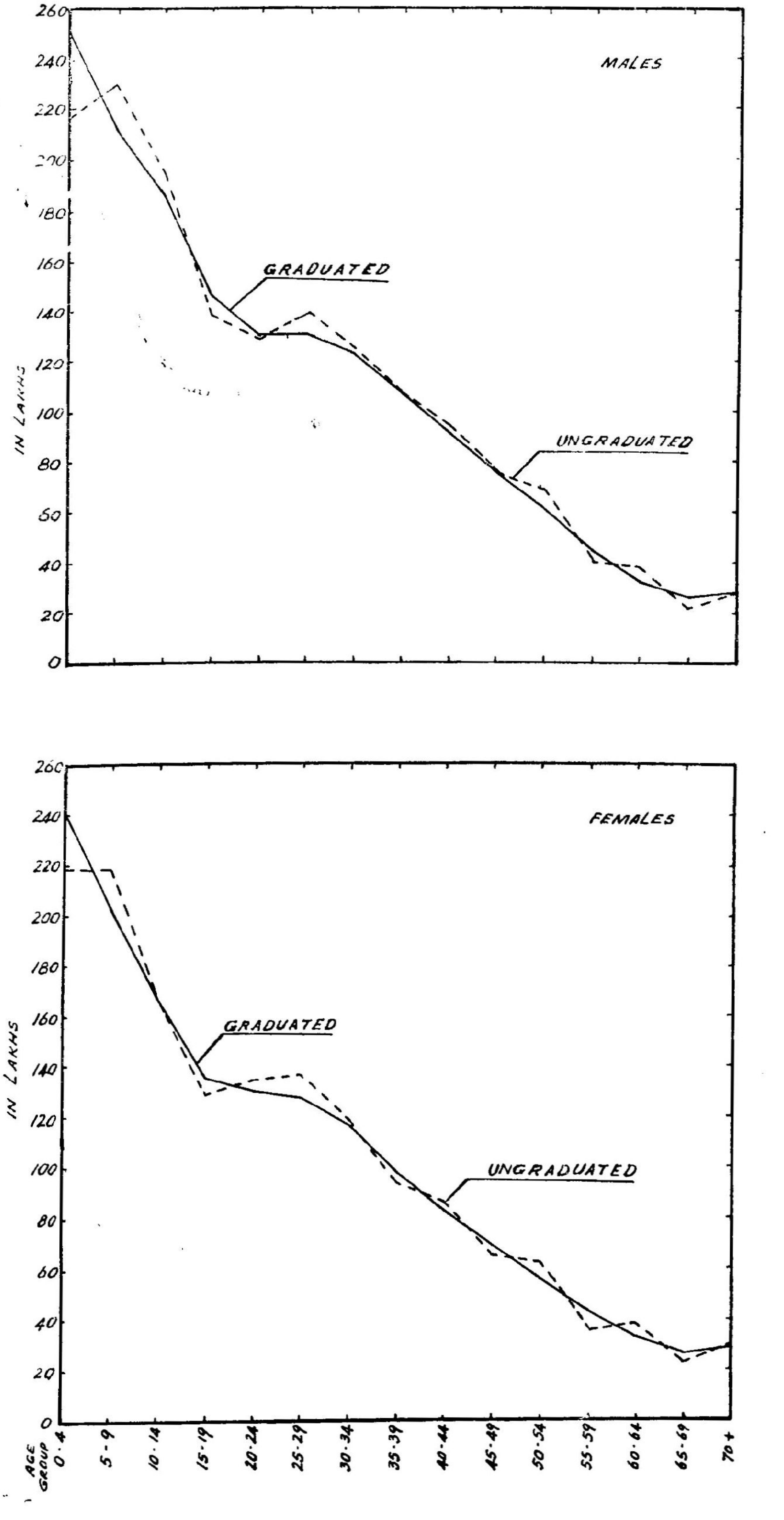
In 1921 and 1931, a provincial summary gives the statistics of age by 5 year age periods, but the provincial summary is useless for our purpose since the province itself has considerably changed in area. For each district, age periods are given in less detail than in the provincial summary, and these were made into five year age groups by applying the proportions in the corresponding five year age groups from the Provincial summary. The district figures were then added up and pro-rated for obtaining the age-sex distribution for the present Madras State area. For 1941 and 1951, the task was less difficult since we had the benefit of the single year age data from which the five year age distribution could be built up. The ungraduated age data for Madras State from 1901 to 1961 are presented in Table III.

TABLE III

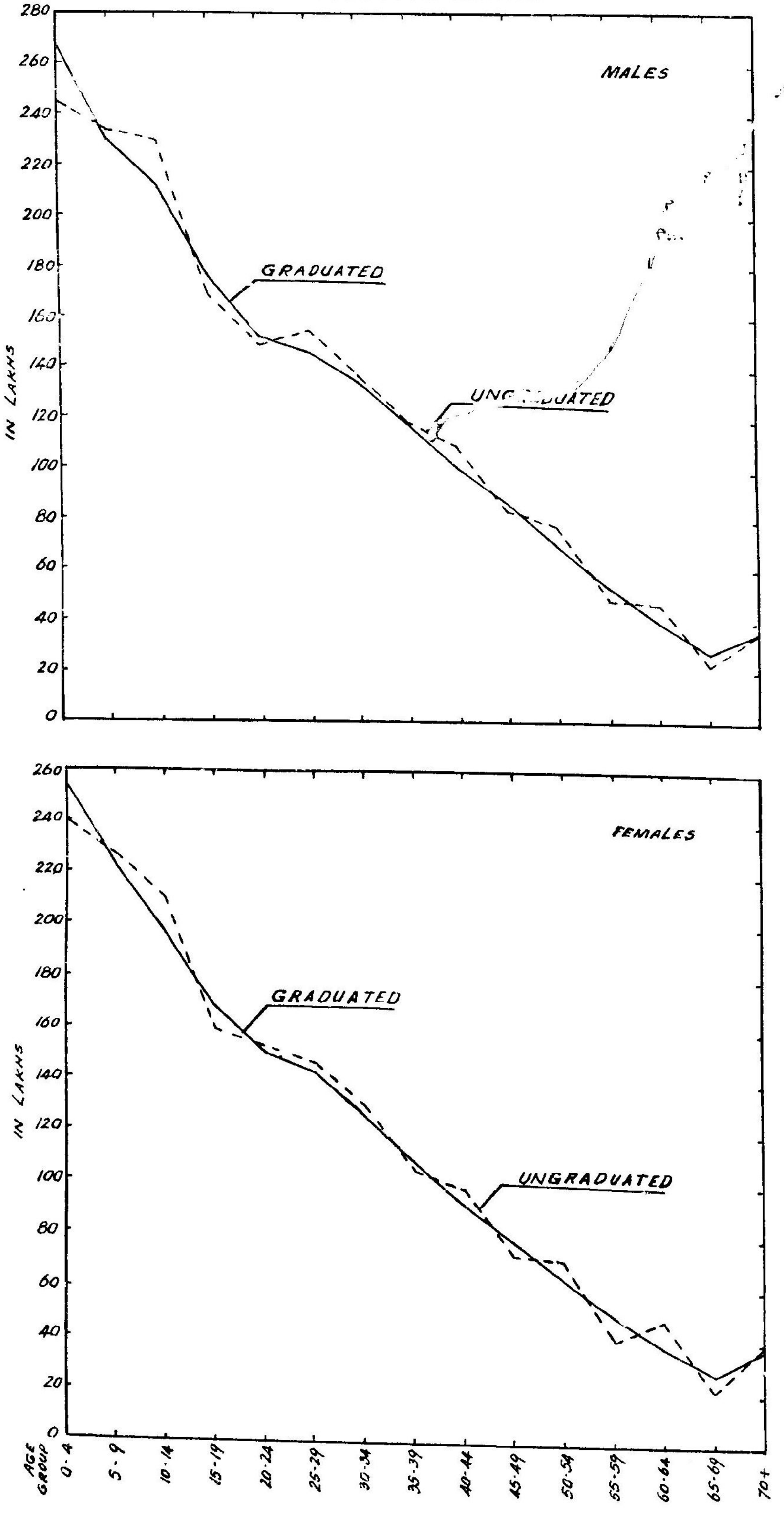
Ungraduated age distribution for Madras State, 1901-61

Age Group	1901		1911		1921		1931	
	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0—4 ...	1,312,726	1,382,550	1,414,366	1,480,544	1,344,972	1,405,616	1,675,093	1,735,354
5—9 ...	1,339,471	1,377,145	1,327,138	1,367,976	1,419,270	1,469,595	1,507,079	1,491,625
10—14 ...	1,165,855	1,070,985	1,198,654	1,118,912	1,267,512	1,184,490	1,375,766	1,319,203
15—19 ...	782,054	733,096	907,626	902,690	920,710	858,759	997,622	1,058,969
20—24 ...	663,364	844,924	829,338	1,003,667	824,276	1,018,335	986,529	1,173,218
25—29 ...	711,703	807,333	805,038	887,061	857,920	963,633	928,690	1,052,157
30—34 ...	753,628	869,119	755,121	863,617	881,070	965,877	896,508	944,138
35—39 ...	559,845	509,453	600,215	565,876	664,667	586,232	778,894	748,777
40—44 ...	640,671	683,223	674,768	722,522	670,927	723,692	673,612	638,683
45—49 ...	361,211	325,731	432,691	392,504	417,180	383,547	502,797	489,334
50—54 ...	443,332	485,626	475,047	514,892	517,033	551,676	411,973	406,483
55—59 ...	181,997	164,746	229,641	208,786	241,191	208,104	304,128	306,269
60—64 ...	261,548	303,448	304,374	333,068	328,382	344,536	245,649	239,965
65—69 ...	83,265	85,629	97,824	94,730	101,994	90,728	124,254	119,267
70+ ...	158,728	190,224	185,110	208,820	202,343	214,190	169,393	170,609
All Ages ...	9,419,398	9,833,232	10,236,951	10,665,665	10,659,447	10,969,010	11,577,987	11,894,051

GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR INDIA, 1941
AFTER PRO-RATING



GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR INDIA, 1951
AFTER PRO-RATING



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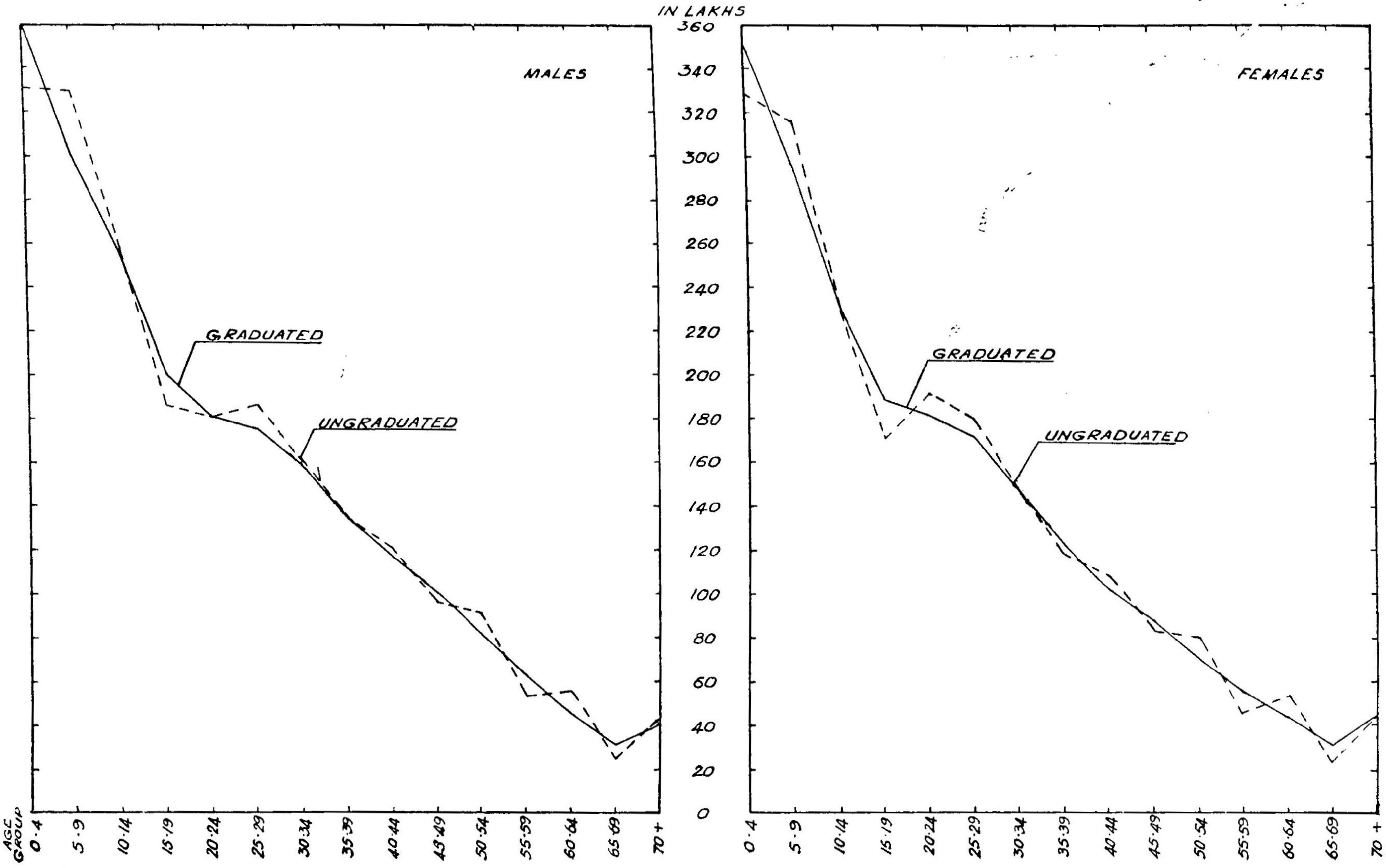
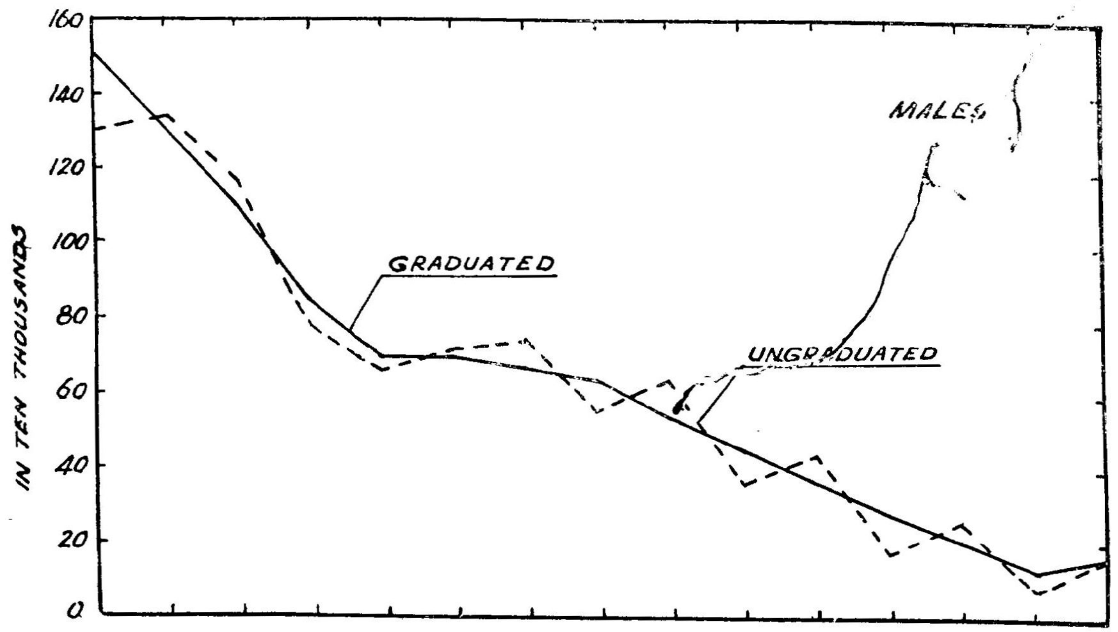


GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR MADRAS STATE

1901



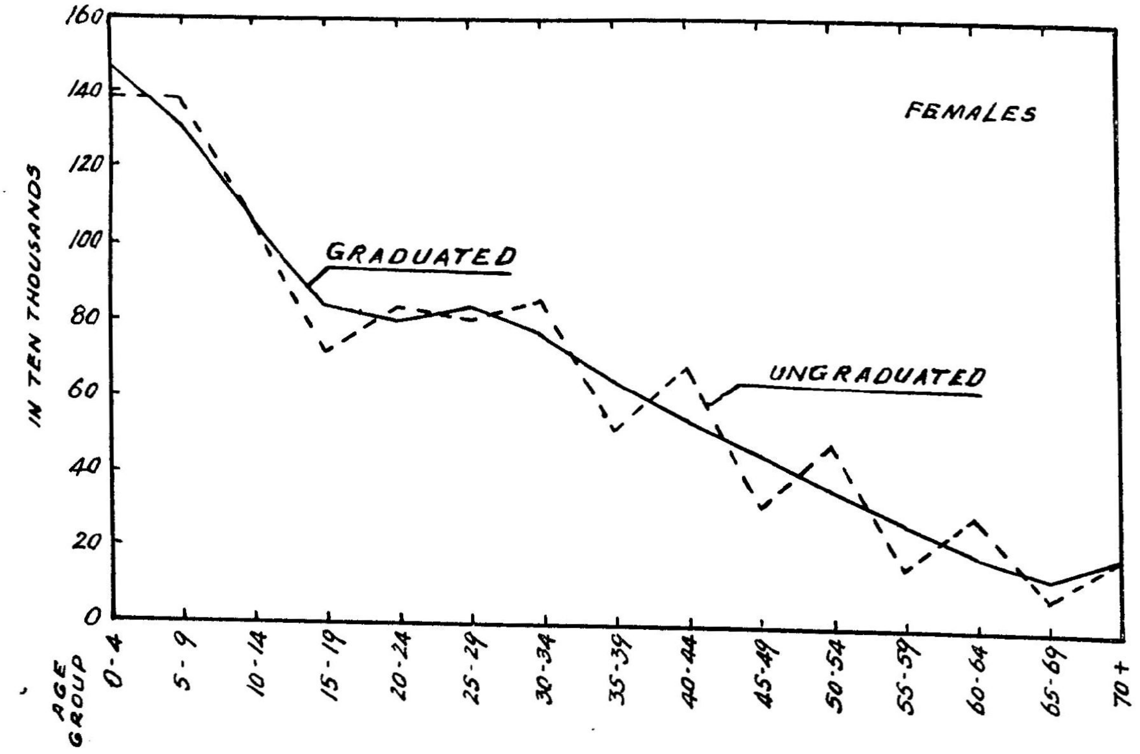


TABLE III—(*Contd.*)

Ungraduated age distribution for Madras State, 1901-61—(*Contd.*)

Age Group		1941		1951		1961	
		Males	Females	Males	Females	Males	Females
		(10)	(11)	(12)	(13)	(14)	(15)
0—4	...	1,770,375	1,787,385	1,805,504	1,815,389	2,310,340	2,299,429
5—9	...	1,771,198	1,803,834	1,772,838	1,803,944	2,160,180	2,147,104
10—14	...	1,560,626	1,477,528	1,831,667	1,835,622	1,912,579	1,837,539
15—19	...	1,254,385	1,235,523	1,474,215	1,397,473	1,438,569	1,414,588
20—24	...	1,103,579	1,219,690	1,214,225	1,315,137	1,418,985	1,552,404
25—29	...	1,033,525	1,161,502	1,229,665	1,302,121	1,390,146	1,523,519
30—34	...	928,907	973,573	1,068,822	1,122,871	1,176,152	1,205,554
35—39	...	850,521	849,075	1,014,729	963,254	1,140,101	1,081,289
40—44	...	727,592	700,212	891,237	867,581	977,909	891,002
45—49	...	623,489	603,985	755,130	734,720	839,730	761,503
50—54	...	475,563	443,299	672,449	674,943	712,349	681,832
55—59	...	363,333	350,260	448,792	423,540	485,372	439,895
60—64	...	249,354	243,753	397,811	416,334	436,660	431,533
65—69	...	154,098	157,499	191,166	192,649	218,669	208,814
70+	...	190,411	203,453	235,480	249,739	291,928	298,842
All Ages	...	13,056,956	13,210,571	15,003,730	15,115,317	16,909,669	16,774,847

Graduation of Age Data

The various defects in the age data are the subject matter of a discussion in the Chapter on Age in the General Report. The Census age returns all over the world, even in most advanced countries are defective in one way or another, but the degree of inaccuracy of Indian age returns is surpassed by few countries. The common defects are :

(1) an under-enumeration of children under 5 years of age.

(2) a through in the age curve between 15 and 24 either due to an under-enumeration or due to mis-statement of age.

(3) a pronounced mis-statement of age leading to an undercount of the 5 year age groups beginning with 5 and an overcount of 5 year age groups beginning with zero. Keeping these observations in view the following procedure has been adopted.

Series-I

The graduated age distribution worked out by Zachariah in his book, " A Historical Study of Internal Migration in the Indian Sub-continent 1901-31 " were adopted with the exception of the 0-4 age group. For this age group, an independent estimate based on the Reverse Survival Method was adoped. It was felt that there was considerable undercount in these Censuses and so the figures were not pro-rated so as to be equal to the Census totals.

Series-II

The graduation formula used is the simple iteration formula :

$$\frac{1}{2^2}(1, 1)^2 = \frac{1}{4}, \frac{1}{2}, \frac{1}{4},$$

It assumes that on an average, the errors in the neighbouring age groups are equal and of opposite sign, and the second difference of the true value is zero.

The application of the formula is straightforward except for the first and last age groups. For India as well as Madras we have estimated the age group 0-4 by the reverse survival method. The last age group 70+ is retained as such for Madras since the error is not likely to be considerable. For India we have adjusted by taking age group as equal to $\frac{3}{4}$ (population aged 70 +) plus $\frac{1}{4}$ (population aged 65—69). The adjusted age distribution are then pro-rated so as to keep the totals unaltered. The graduated age distribution for India and Madras State are presented in Tables IV and V.

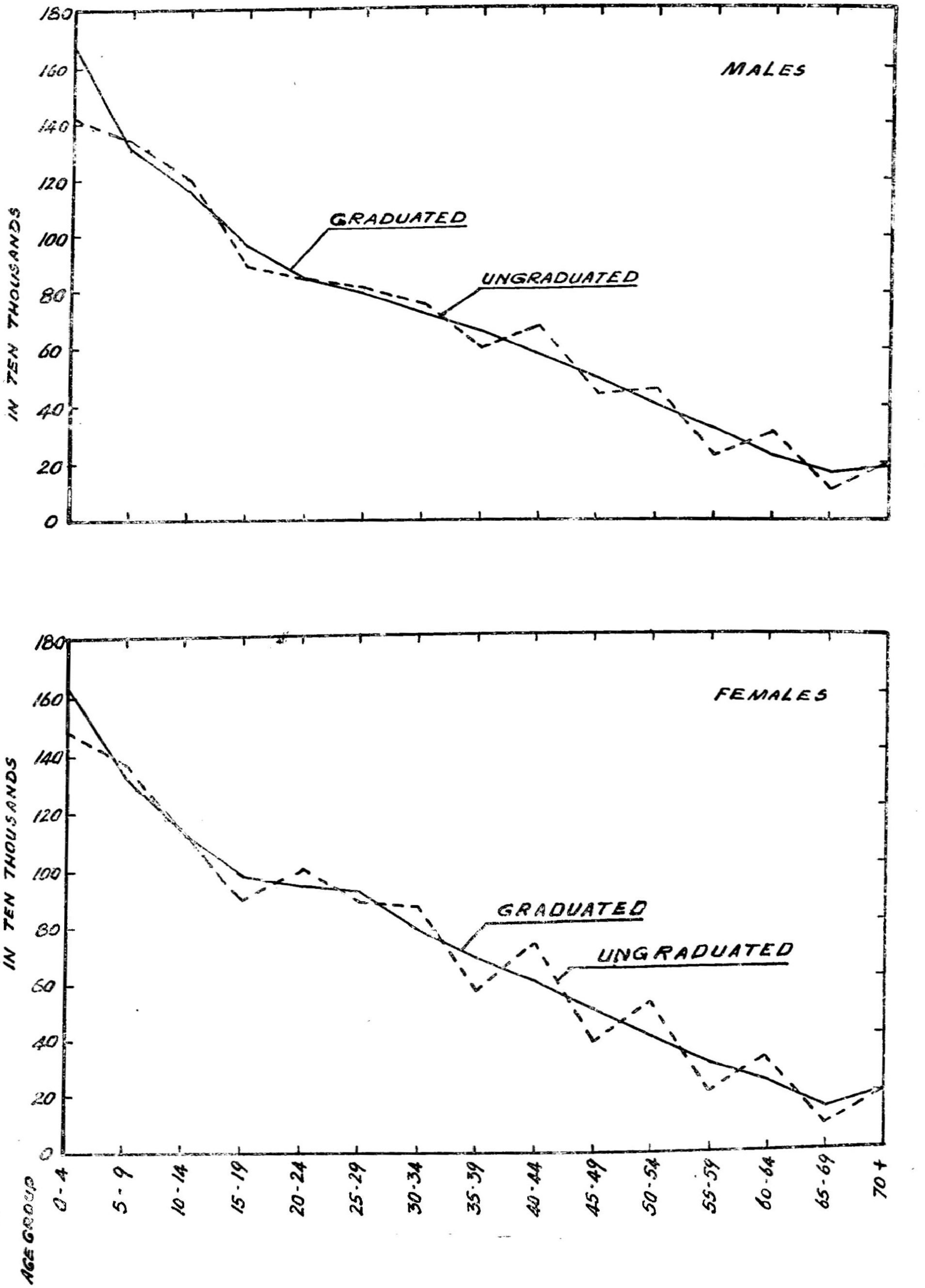
TABLE IV

Graduated age distribution for India, 1921-61

(After Pro-rating)

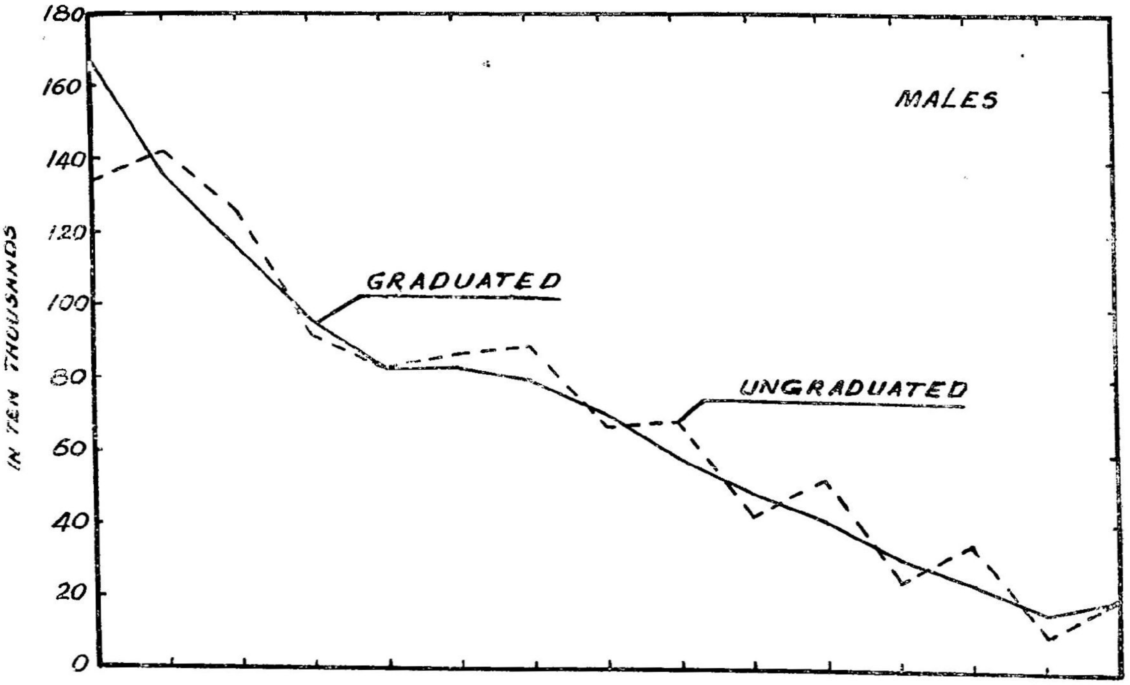
Age Group	1921		1931		1941		1951		1961	
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
0—4 ...	18,130,000	17,829,000	22,572,000	22,160,000	24,949,000	24,127,000	26,667,000	25,439,000	36,103,000	35,269,000
5—9 ...	16,879,000	16,099,000	18,499,000	17,448,000	21,266,000	20,114,000	23,096,000	22,250,000	30,892,000	29,313,000
10—14 ...	15,115,000	13,386,000	16,100,000	14,742,000	18,462,000	16,570,000	21,215,000	19,837,000	25,626,000	23,352,000
15—19 ...	11,637,000	10,633,000	13,604,000	13,120,000	14,631,000	13,537,000	17,648,000	16,798,000	20,078,000	18,871,000
20—24 ...	10,219,000	10,298,000	12,448,000	12,482,000	13,066,000	12,978,000	15,254,000	15,062,000	18,075,000	18,103,000
25—29 ...	10,509,000	10,564,000	11,913,000	11,620,000	12,965,000	12,838,000	14,526,000	14,162,000	17,517,000	17,239,000
30—34 ...	9,999,000	9,596,000	10,783,000	10,051,000	12,067,000	11,472,000	13,364,000	12,571,000	15,763,000	14,664,000
35—39 ...	8,661,000	8,033,000	9,246,000	8,356,000	10,536,000	9,696,000	11,862,000	10,752,000	13,593,000	12,136,000
40—44 ...	7,264,000	6,705,000	7,678,000	6,831,000	9,010,000	8,158,000	10,345,000	9,173,000	11,683,000	10,261,000
45—49 ...	5,904,000	5,448,000	6,171,000	5,479,000	7,596,000	6,806,000	8,739,000	7,730,000	10,006,000	8,703,000
50—54 ...	4,654,000	4,325,000	4,723,000	4,294,000	6,106,000	5,487,000	7,078,000	6,295,000	8,184,000	7,088,000
55—59 ...	3,440,000	3,342,000	3,483,000	3,341,000	4,509,000	4,151,000	5,394,000	4,954,000	6,246,000	5,557,000
60—64 ...	2,548,000	2,640,000	2,426,000	2,436,000	3,327,000	3,238,000	3,985,000	3,914,000	4,713,000	4,422,000
65—69 ...	1,606,000	1,677,000	1,571,000	1,596,000	2,518,000	2,573,000	2,766,000	2,791,000	3,227,000	3,114,000
70+ ...	1,981,000	2,200,000	1,713,000	1,833,000	2,677,000	2,945,000	3,589,000	3,832,000	4,107,000	4,367,000
All Ages ...	128,546,000	122,775,000	142,930,000	135,789,000	163,685,000	154,690,000	185,528,000	175,560,000	225,813,000	212,459,000

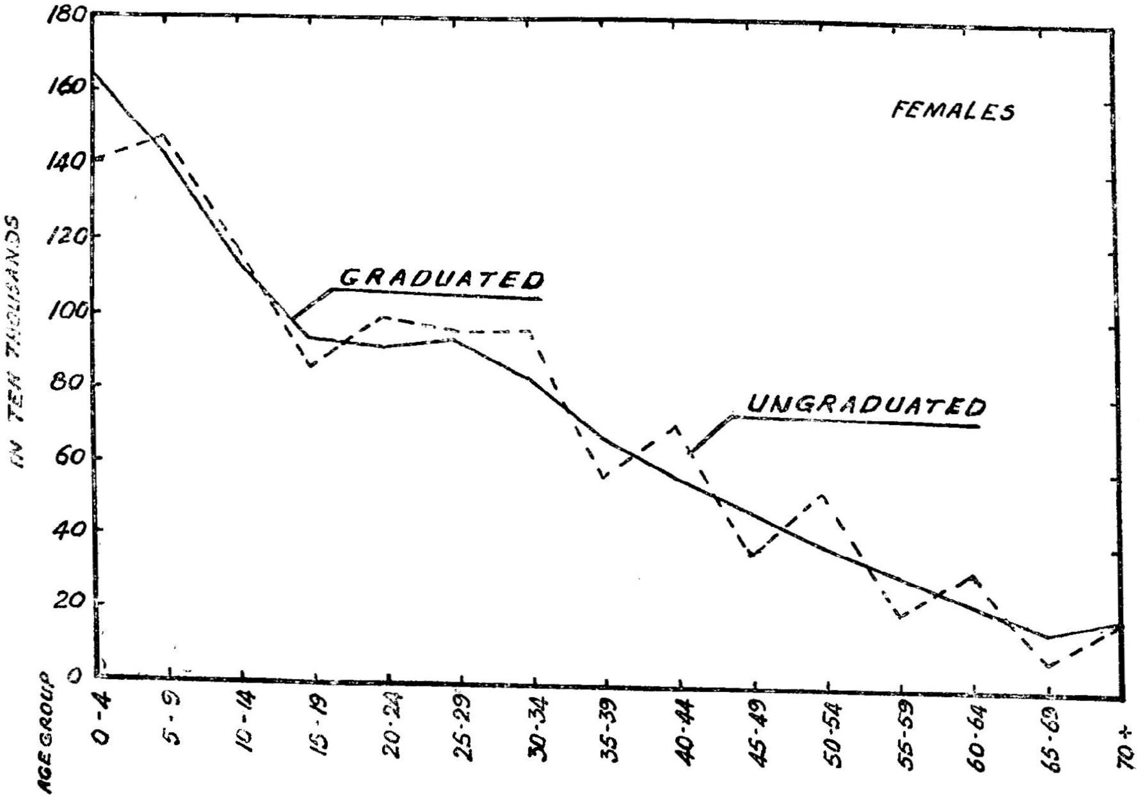
GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR MADRAS STATE
1911



GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR MADRAS STATE

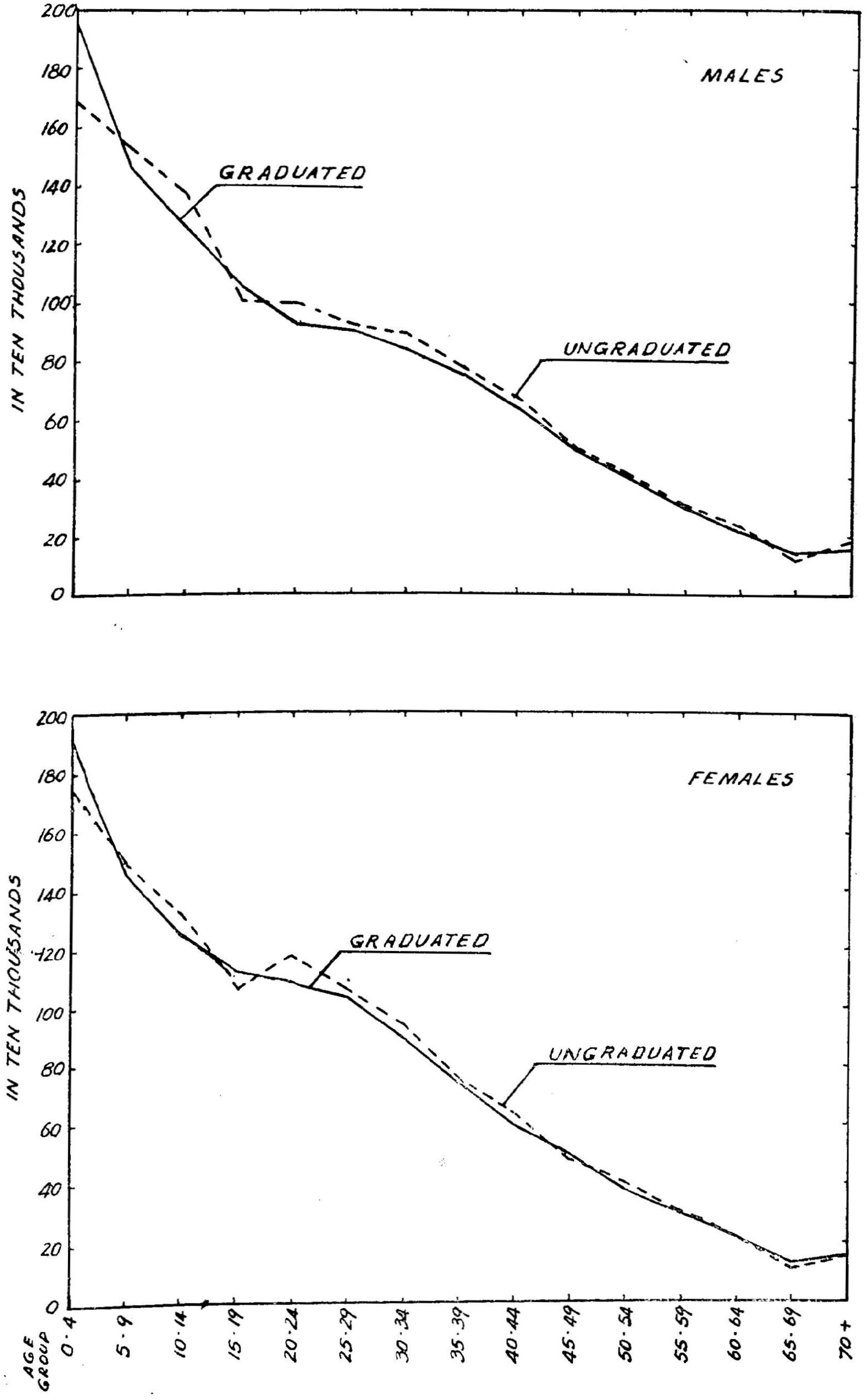
1921





GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR MADRAS STATE

1931



GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR MADRAS STATE
1941

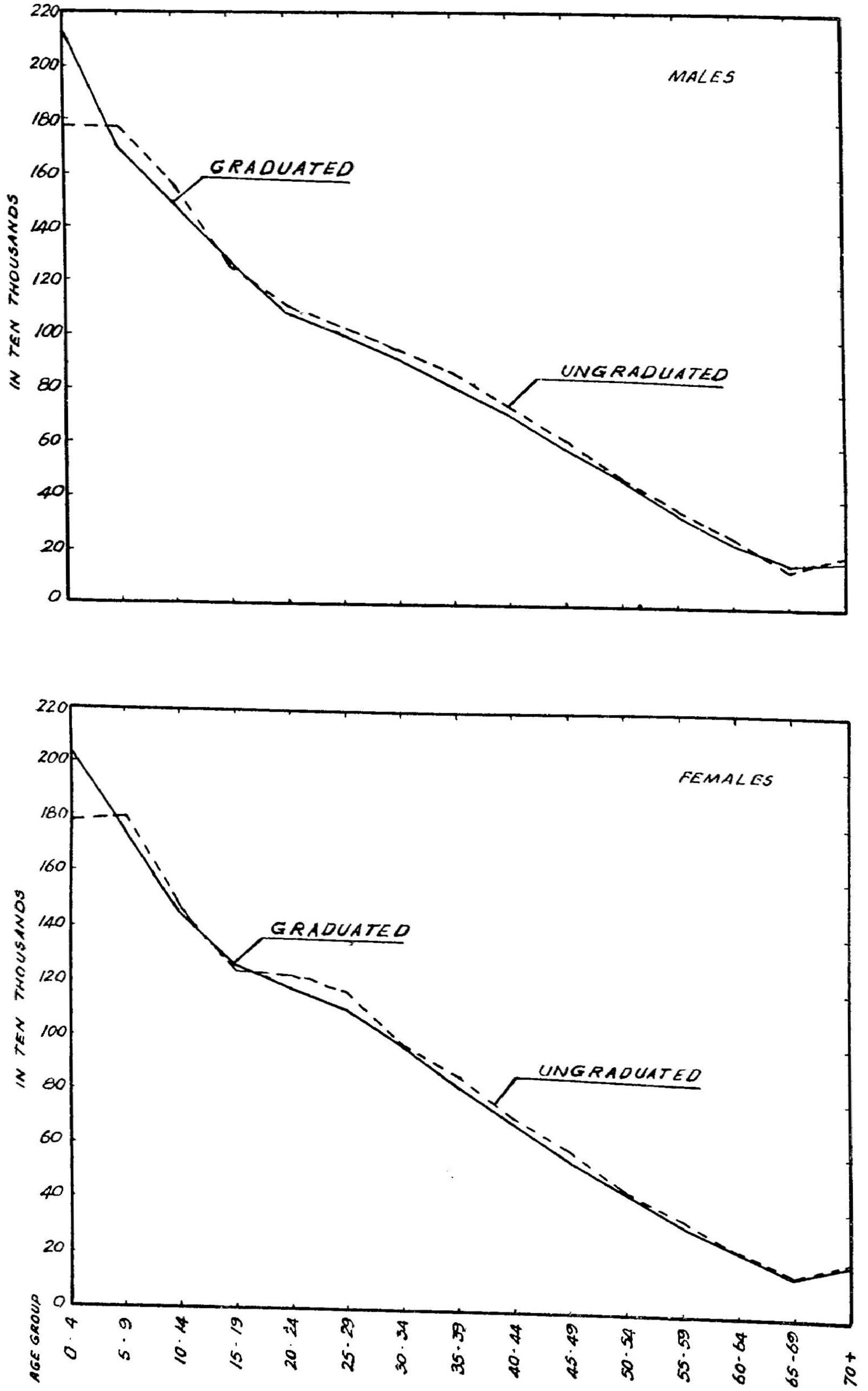


TABLE V

Graduated age distribution for Madras State, 1901–61

Age Group	1901		1911		1921		1931	
	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0—4 ...	1,493,928	1,468,607	1,653,582	1,625,555	1,654,850	1,636,130	1,956,204	1,911,972
5—9 ...	1,289,381	1,301,956	1,316,824	1,333,852	1,365,891	1,422,215	1,460,284	1,460,092
10—14 ...	1,113,309	1,063,053	1,158,018	1,127,123	1,172,914	1,136,473	1,273,256	1,269,826
15—19 ...	848,332	845,525	960,811	981,990	946,320	948,488	1,055,560	1,128,224
20—24 ...	705,121	807,569	842,835	949,271	824,572	933,661	944,574	1,090,833
25—29 ...	710,100	832,177	798,634	910,352	823,129	946,343	906,069	1,033,106
30—34 ...	694,701	763,756	728,874	795,043	790,297	842,342	847,977	902,806
35—39 ...	628,497	642,812	657,580	679,473	693,241	692,440	757,697	753,814
40—44 ...	550,600	550,408	595,611	600,856	583,136	584,808	636,822	615,575
45—49 ...	451,606	455,078	503,799	505,606	486,565	494,153	506,562	495,263
50—54 ...	357,468	365,432	403,107	407,769	407,196	410,089	395,058	393,641
55—59 ...	267,219	279,642	309,676	316,383	319,464	317,527	306,644	308,093
60—64 ...	197,090	214,318	234,053	242,413	240,585	239,013	222,781	221,582
65—69 ...	127,836	140,084	149,462	154,315	156,554	158,043	144,366	142,222
70+ ...	158,728	190,224	185,110	208,820	194,733	207,285	164,133	167,002
All Ages ...	9,593,916	9,920,641	10,497,976	10,838,821	10,659,447	10,969,010	11,577,987	11,894,051

TABLE V—(*Contd.*)

Graduated age distribution for Madras State, 1901-61—(*Contd.*)

Age Group	1941		1951		1961	
	Males	Females	Males	Females	Males	Females
	(10)	(11)	(12)	(13)	(14)	(15)
0—4 ...	2,123,305	2,038,984	2,192,722	2,090,656	2,668,093	2,449,059
5—9 ...	1,709,720	1,753,327	1,724,670	1,769,507	2,100,602	2,115,456
10—14 ...	1,483,419	1,456,642	1,680,660	1,685,365	1,804,788	1,782,525
15—19 ...	1,248,380	1,255,888	1,457,864	1,458,050	1,509,366	1,531,862
20—24 ...	1,084,736	1,175,246	1,248,219	1,307,028	1,377,594	1,488,460
25—29 ...	989,310	1,097,503	1,153,384	1,236,496	1,306,793	1,429,858
30—34 ...	903,020	961,702	1,065,745	1,106,253	1,186,972	1,235,495
35—39 ...	810,275	819,405	970,280	960,543	1,077,991	1,049,088
40—44 ...	706,905	693,397	863,954	841,902	956,776	892,842
45—49 ...	591,322	571,485	747,604	738,613	819,195	762,552
50—54 ...	467,696	447,375	619,892	615,064	668,490	631,813
55—59 ...	350,325	337,254	478,599	475,338	515,322	490,943
60—64 ...	245,267	241,825	349,149	355,296	383,464	372,372
65—69 ...	159,474	162,782	221,906	230,235	250,346	248,085
70+ ...	183,802	197,756	229,082	244,971	283,877	294,437
All Ages ...	13,056,956	13,210,571	15,003,730	15,115,317	16,909,669	16,774,847

Computation of Survival Ratios

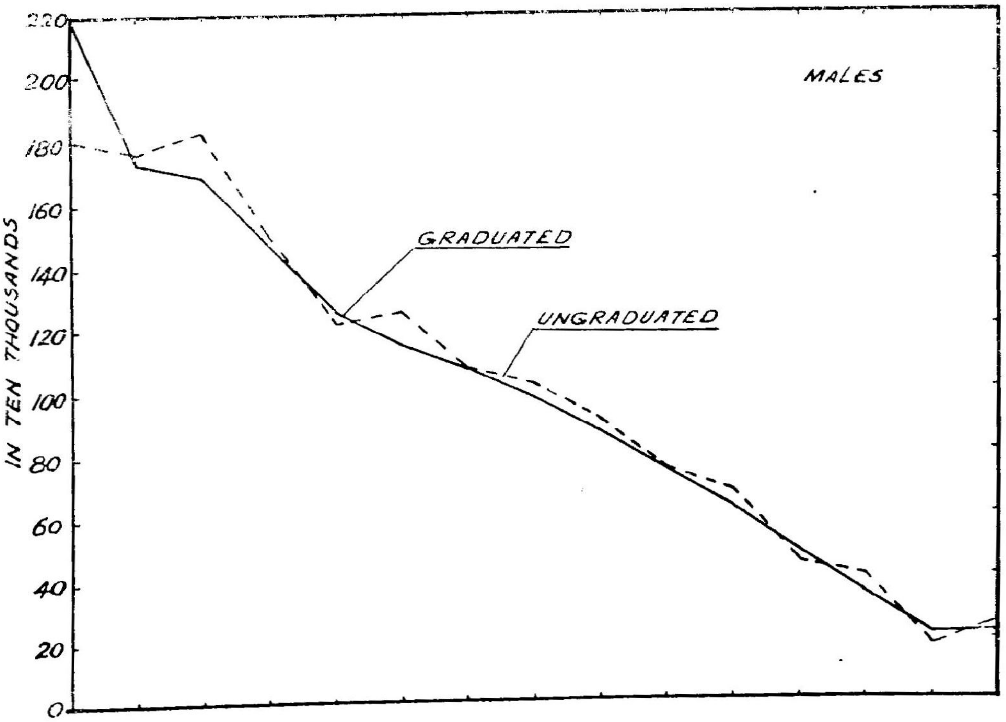
From the graduated age data for India obtained above, the Census Survival Ratios are computed by the usual formula :

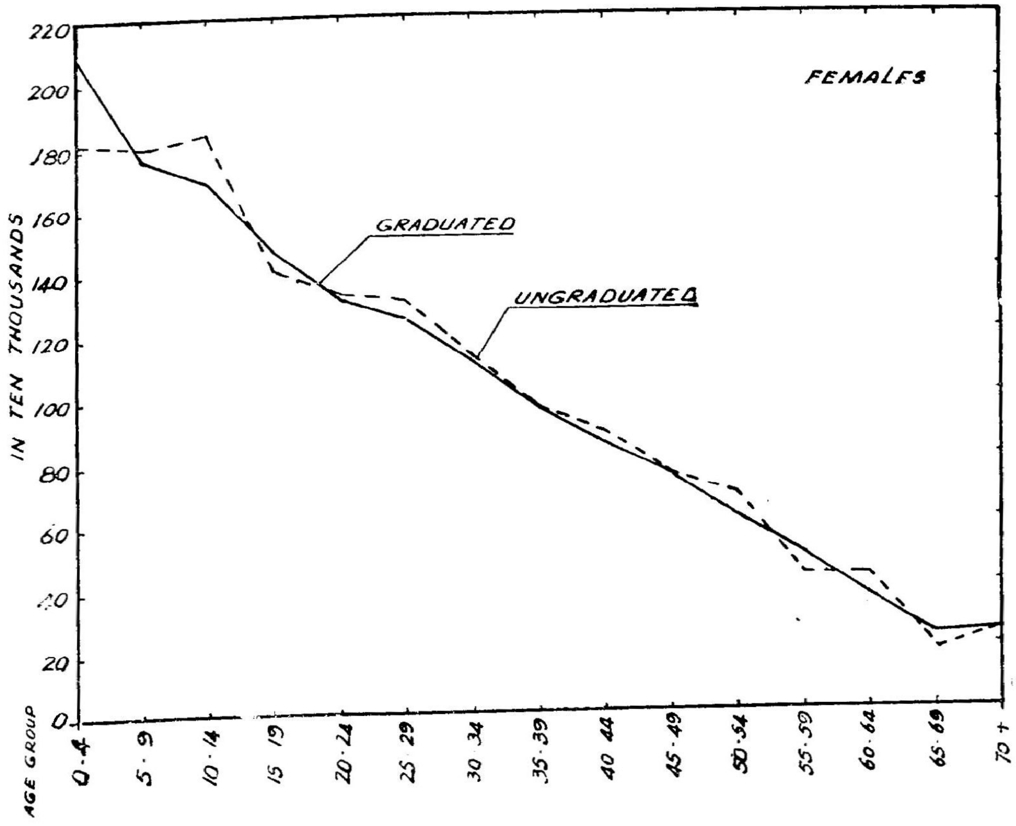
$$S\,(x \text{ to } x+4 : x+10 \text{ to } x+14) = \frac{P_c^2\,(x+10 \text{ to } x+14)}{P_c^1\,(x \text{ to } x+4)}$$

where S is the Census Survival Ratio for a particular decade and for a particular age-sex group, P_c^1 (x to x+4) is the national population in a particular five year age-sex group at a particular Census and P_c^2 is the national population in the age group 10 years older at the next Census. These ratios are given, for males and females separately, in Tables VI for 1901–11, 1911–21 and 1921–31 for India including Pakistan and Burma and in Table VII for 1921–31, 1931–41, 1941–51 and 1951–61 for India as constituted now. These survival ratios have been used in Chapter XII for computation of migration rates for Madras State.

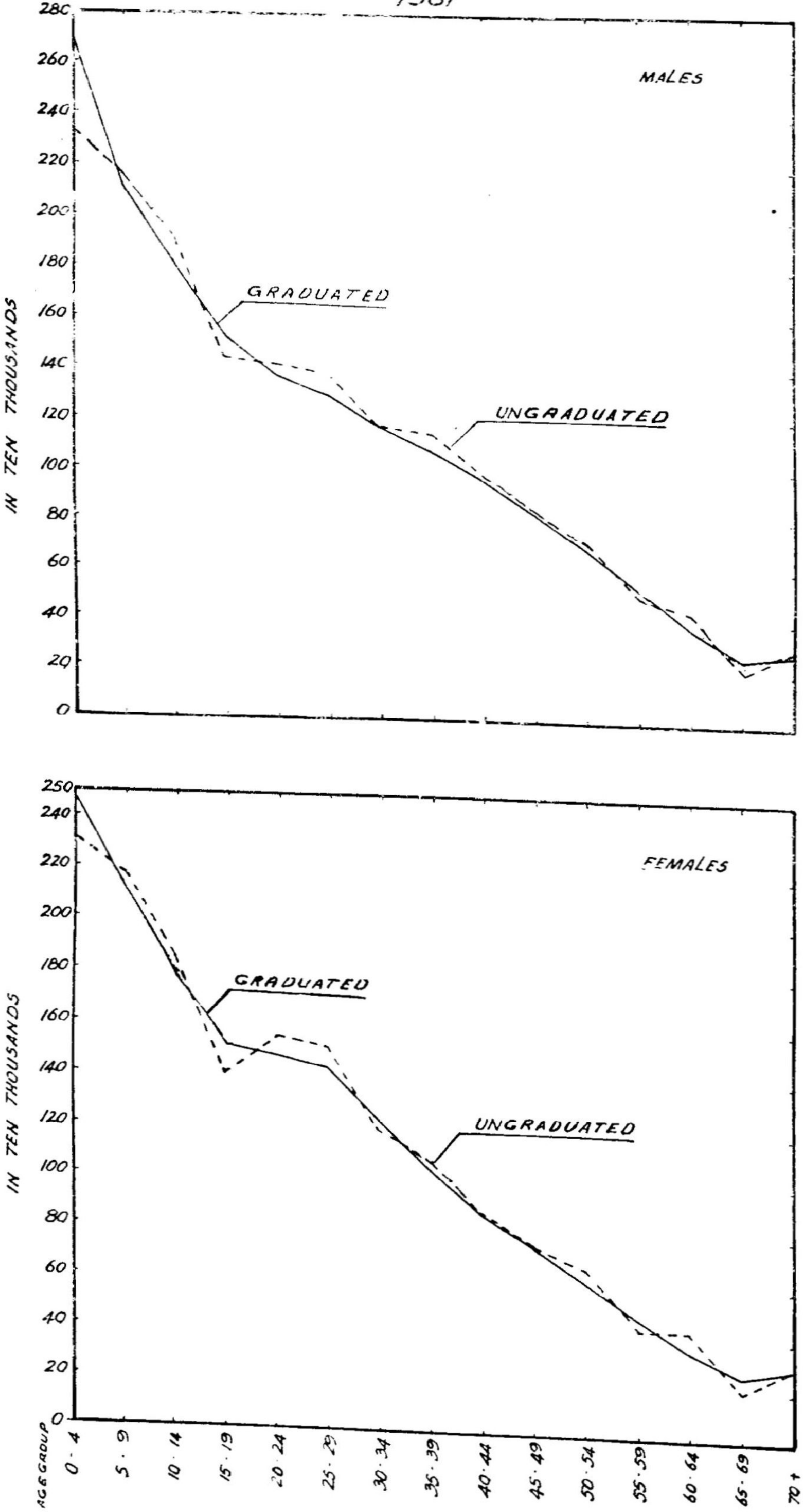
GRADUATED & UNGRĂDUATED AGE DISTRIBUTION FOR MADRAS STATE

1951

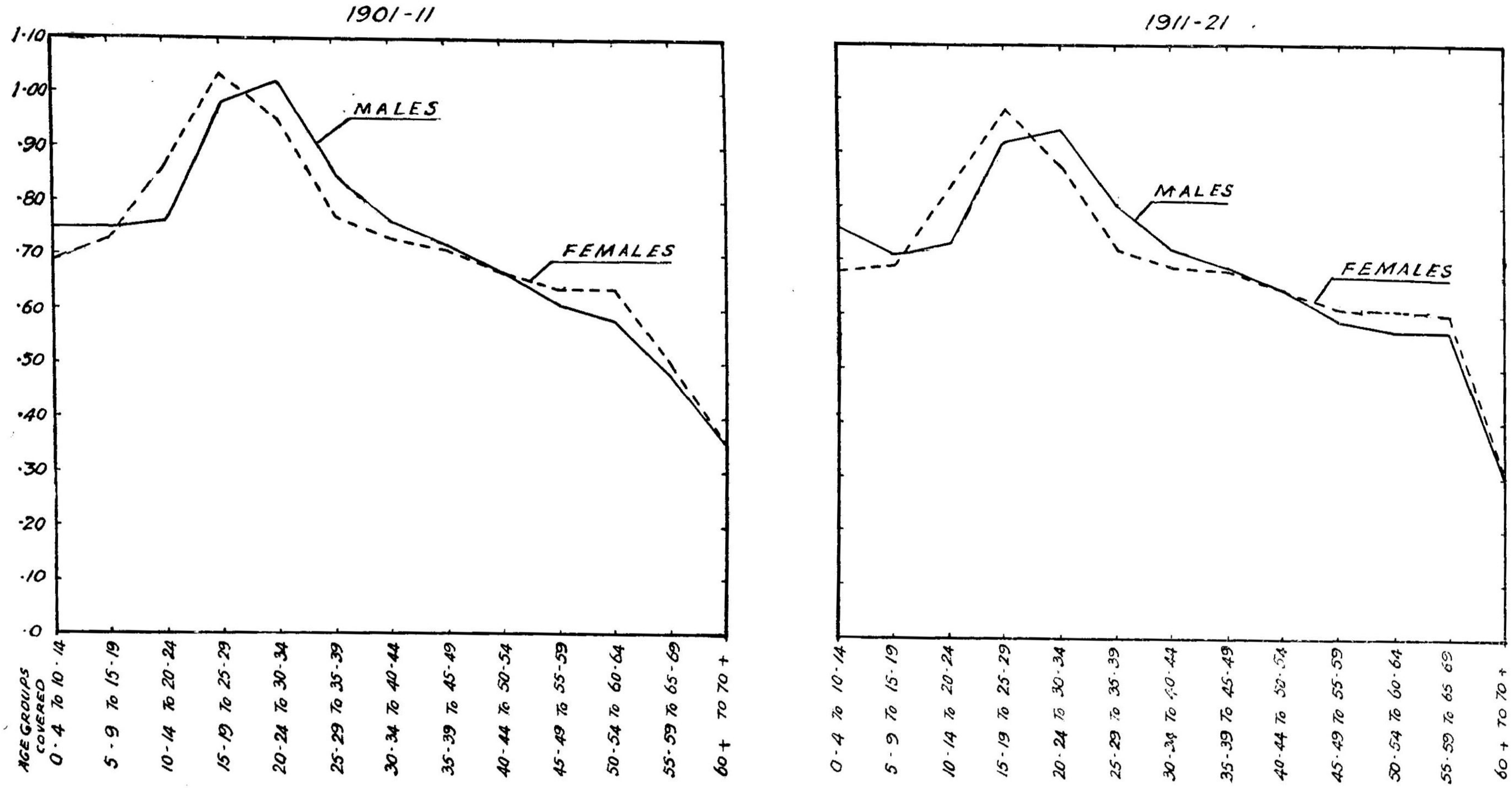




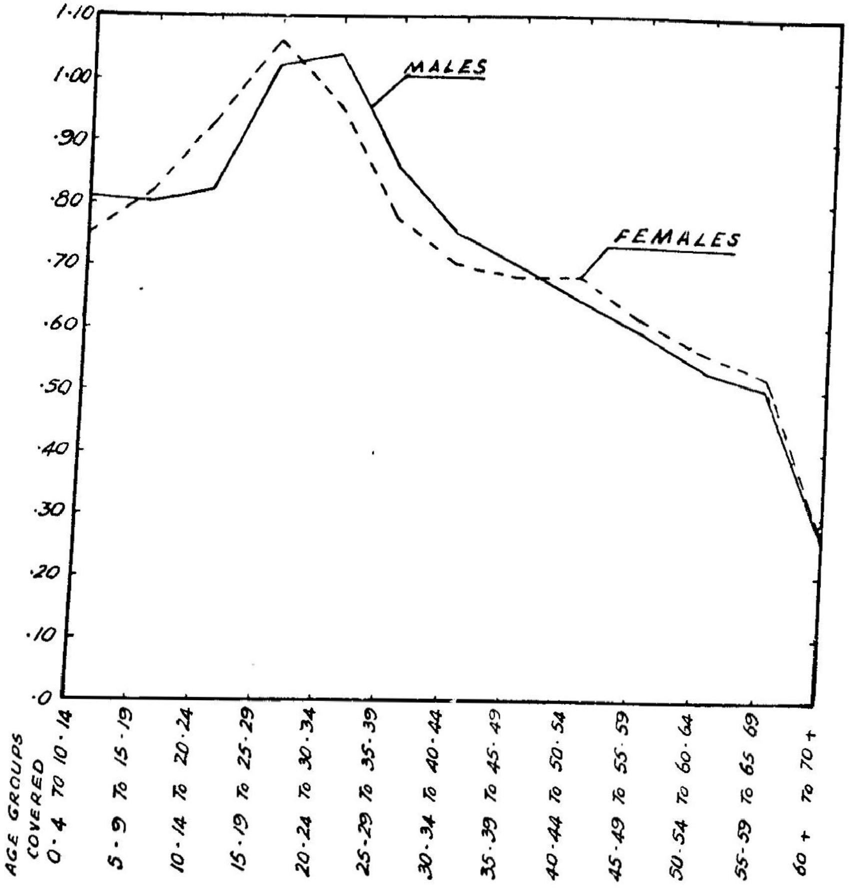
GRADUATED & UNGRADUATED AGE DISTRIBUTION FOR MADRAS STATE 1961



SURVIVAL RATIOS FOR INDIA BASED ON GRADUATED DATA (INDIA INCLUDING PAKISTAN & BURMA)



SURVIVAL RATIOS FOR INDIA BASED ON GRADUATED DATA, 1921-31
(INDIA INCLUDING PAKISTAN & BURMA)



SURVIVAL RATIOS FOR INDIA BASED ON GRADUATED DATA, 1921-31
(INDIA AS CONSTITUTED NOW)

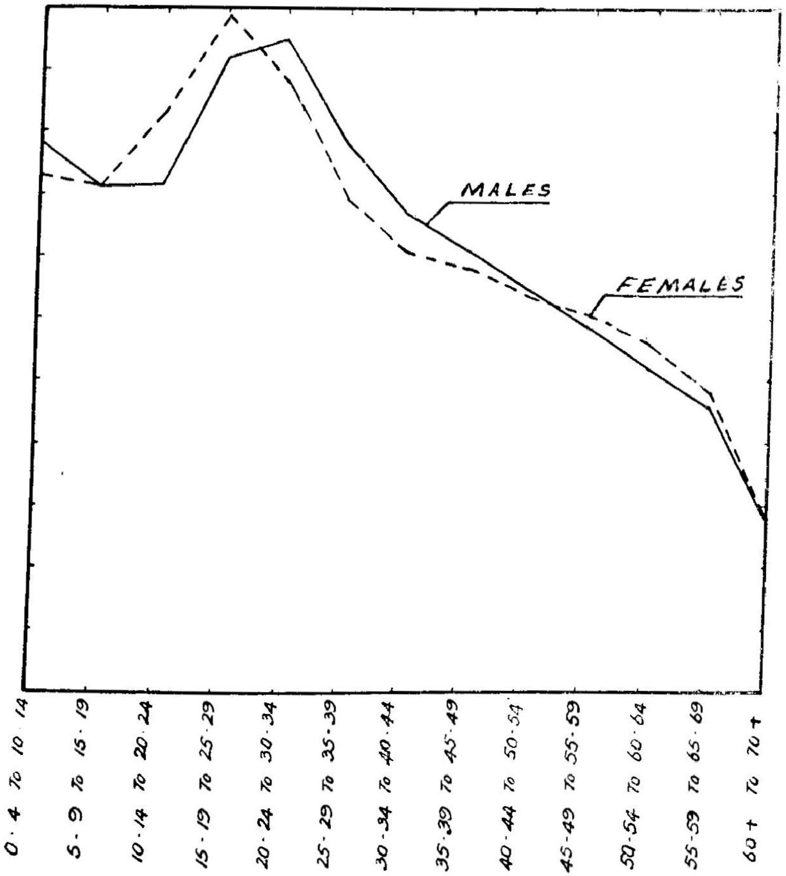


TABLE VI

Survival Ratio for India based on graduated data, 1901-11, 1911-21 and 1921-31*

(India including Pakistan and Burma)

Age Group		1901—11		1911—21		1921—31	
		Males	Females	Males	Females	Males	Females
(1)		(2)	(3)	(4)	(5)	(6)	(7)
0—4 to 10—14	...	.75300	.69571	.75727	.68131	.81044	.75553
5—9 to 15—19	...	.74902	.73579	.71745	.69571	.80063	.81601
10—14 to 20—24	...	.76544	.87540	.73005	.83008	.82460	.93258
15—19 to 25—29	...	.98090	1.04799	.92187	.98121	1.02208	1.06929
20—24 to 30—34	...	1.02603	.95062	.94344	.87313	1.04383	.94797
25—29 to 35—39	...	.85633	.77787	.79974	.72579	.86819	.77535
30—34 to 40—44	...	.76676	.72833	.72475	.69076	.75759	.70519
35—39 to 45—49	...	.72396	.71201	.68951	.68324	.70444	.68212
40—44 to 50—54	...	.67153	.67110	.64626	.64869	.64619	.68170
45—49 to 55—59	...	.61301	.64082	.59539	.61659	.59067	.61245
50—54 to 60—64	...	.58430	.63861	.57110	.61190	.52705	.56199
55—59 to 65—69	...	.48450	.49731	.57310	.59685	.50310	.52520
60+ to 70 +	...	.35347	.34680	.30654	.30029	.26355	.26126

* Survival Ratios for age groups 5-9 to 60+ taken from K. C. Zachariah's Report: 'A Historical Study of Internal Migration in the Indian Sub-Continent, 1901-31.' The figures for 0-4 to 10-14 have been computed by us.

TABLE VII

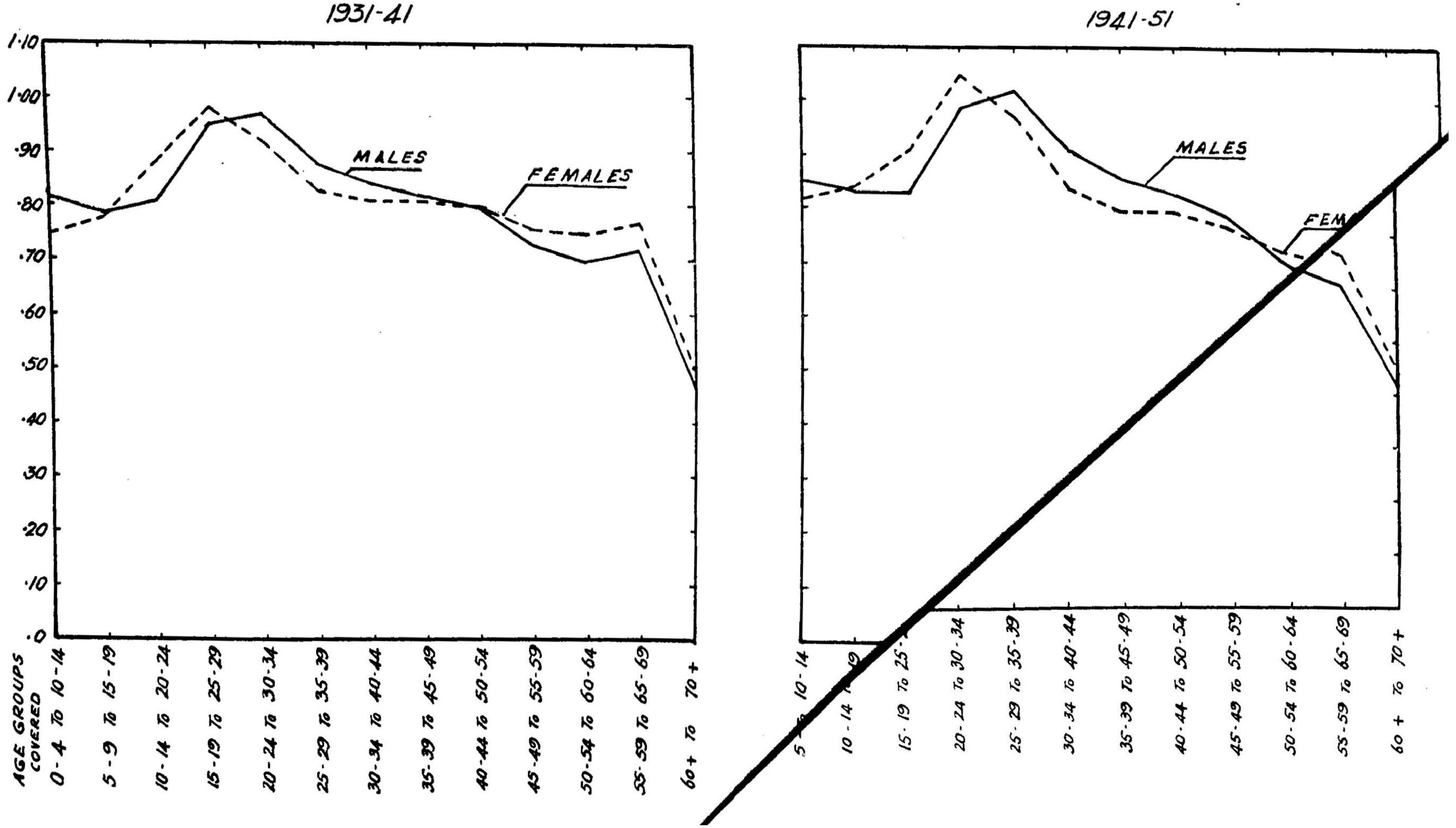
Survival Ratio for India based on graduated data 1921-31, 1931-41, 1941-51 and 1951-61*

(India as constituted now)

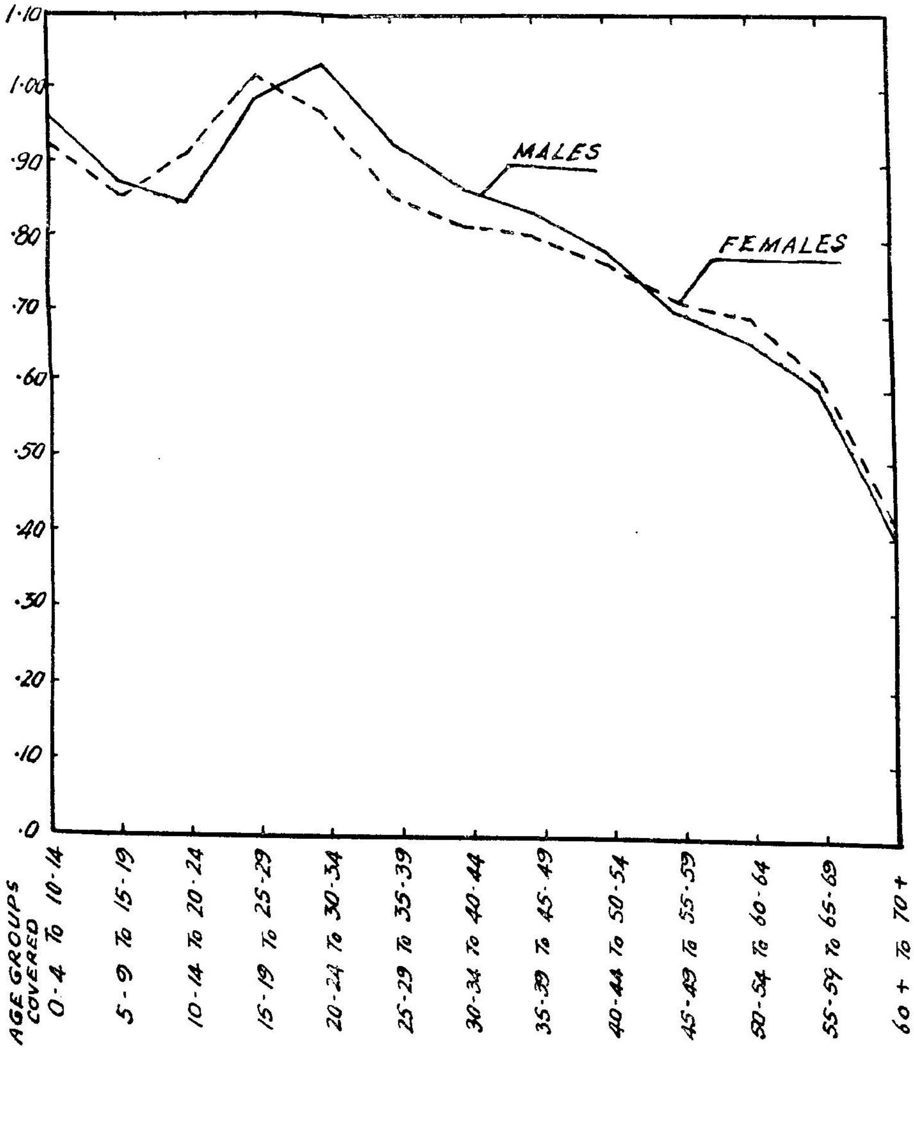
Age Group	1921-31		1931-41		1941-51		1951-61	
	Males	Females	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
0—4 to 10—14 ...	.88803	.82686	.81792	.74774	.85033	.82219	.96096	.91796
5—9 to 15—19 ...	.80597	.81496	.79091	.77585	.82987	.83514	.86933	.84813
10—14 to 20—24 ...	.82355	.93247	.81155	.88034	.82624	.90899	.85199	.91259
15—19 to 25—29 ...	1.02372	1.09282	.95303	.97851	.99282	1.04617	.99258	1.02625
20—24 to 30—34 ...	1.05519	.97601	.96939	.91908	1.02281	.96864	1.03337	.97358
25—29 to 35—39 ...	.87982	.79099	.88441	.83442	.91492	.83751	.93577	.85694
30—34 to 40—44 ...	.76788	.71186	.83557	.81166	.85730	.79960	.87421	.81624
35—39 to 45—49 ...	.71250	.68206	.82154	.81450	.82944	.79724	.84353	.80943
40—44 to 50—54 ...	.65019	.64042	.79526	.80325	.78557	.77164	.79111	.77270
45—49 to 55—59 ...	.58994	.61325	.73068	.75762	.71011	.72789	.71473	.71889
50—54 to 60—64 ...	.52127	.56324	.70443	.75408	.65264	.71332	.66587	.70246
55—59 to 65—69 ...	.45669	.47756	.72294	.77013	.61344	.67237	.59826	.62858
60 + to 70 + ...	.27922	.28126	.46883	.50213	.42115	.43764	.39720	.41444

* Survival Ratios for age groups 5–9 to 60+ taken from K. C. Zachariah's Report: "A Historical Study of Internal Migration in the Indian Sub-Continent". The figures for 0–4 to 10–14 have been computed by us.

SURVIVAL RATIOS FOR INDIA BASED ON GRADUATED DATA (INDIA AS CONSTITUTED NOW)



SURVIVAL RATIOS FOR INDIA BASED ON GRADUATED DATA, 1951-61
(INDIA AS CONSTITUTED NOW)



APPENDIX XXIII

NOTE ON THE ADJUSTMENT OF PLACE OF BIRTH DATA FOR EARLIER CENSUSES

1951

(a) Methodology of estimation of number of in-migrants in 1951

The data on migration pertaining to the 1951 Census are available in (1) Sub-Table 1-4 at pages 46-47 of Part I Report (Vol. III, 1951 Census, Madras & Coorg) and (2) D-IV Migrants at pp. 152-178 of Part II-B Tables (Vol. III, 1951 Census, Madras & Coorg). In neither of these, the migrants are cross-classified by district of birth and district of enumeration.

In the former statement, the number of persons enumerated in each district but born in other districts of the same natural division is given. Obviously, these figures should have been built up from the district level but the relevant working sheets/Compiler Posting Statements are not traceable. In the above circumstances, the following procedure has been employed for estimating the migrants as adjusted to the present boundaries of Madras State.

The South Madras Division of 1951 Census covers all but a portion of the present Madras State and includes Chittoor district but excludes the Nilgiris & Kanyakumari districts of the present Madras State. The migrants to the South Madras Division is worked out thus :

Migrants to the South Madras Division=

Persons born in the districts outside the South Madras Division.

+ Persons born in adjacent States.

+ Persons born in other States in India.

The number of migrants to the South Madras Division may then be inflated on a pro-rata basis in relation to the population of present Madras State to arrive at the number of migrants adjusted to the present Madras State. For some districts like Chingleput, North Arcot, Salem, Tirunelveli, Nilgiris and Kanyakumari, it is necessary to estimate the in-migration from the ceded portion to the portions added to the present Madras State. The above adjustment was made by working out a reduction factor for the added areas and then applying the reduction factor to the total out-migrants from the ceded areas. A statement showing the district-wise migrants is furnished in Table I. The total in-migrants to present Madras area from the rest of India in 1951 was estimated at 456,147.

TABLE I

Estimated Life-time migrants to Madras State, 1951 Census

District		Persons	Males	Females
(1)		(2)	(3)	(4)
Madras	...	132,496	77,554	54,942
Chingleput	...	65,276	26,615	38,661
North Arcot	...	27,047	11,884	15,163
South Arcot	...	16,599	7,047	9,552
Salem	...	24,484	10,068	14,416
Coimbatore	...	63,366	34,187	29,179
Nilgiris	...	32,327	18,329	13,998
Madurai	...	16,678	9,130	7,548
Tiruchirapalli	...	19,790	10,492	9,298
Thanjavur	...	17,862	9,268	8,594
Ramanathapuram	...	14,418	6,578	7,840
Tirunelveli	...	13,354	6,698	6,656
Kanyakumari	...	12,450	7,302	5,148
State	...	456,147	235,152	220,995

(b) The estimation of out-migrants from present Madras State to other States in 1951

In 1951, Madras State included areas of the present Andhra Pradesh and Kerala and persons born in Madras State and enumerated in other States included the persons born in these areas. The Census Tables D-IV in Part II-B of the enumerating States do not provide for the districts or Natural Divisions of the States where the migrants were born ; these figures must be available in the Tabulation Sheets/Compiler Posting Statements of each State, but all these Compiler Posting Statements have been destroyed now. Hence, the only possibility open to us is to find out the number of migrants born in the composite Madras State and enumerated in each of the other States as they existed then. In Part-II-A, Demographic Tables Vol. I, of Census of India, 1951, the D-IV Tables cross-classify the State where born and the State where enumerated and from this table the number of out-migrants from the composite Madras State to the other States is extracted. (Vide Table II).

TABLE II

Place of Birth Data on Migrants for Composite Madras State, 1951 Census

State	Persons enumerated in Madras State and born in other States			Persons born in Madras State and enumerated in other States		
	Persons	Males	Females	Persons	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Uttar Pradesh ...	3,388	2,194	1,194	13,511	10,117	3,394
Bihar ...	700	413	287	18,311	9,573	8,738
Orissa ...	14,645	7,432	7,213	34,127	19,519	14,608
West Bengal ...	3,706	2,020	1,686	52,001	32,626	19,375
Assam ...	347	126	221	12,719	6,703	6,016
Manipur ...	1	1	...	6	6	...
Tripura ...	...	...	...	43	35	8
Sikkim ...	...	...	...	...	...	...
Mysore ...	115,336	49,966	65,370	525,517	278,731	246,786
Travancore-Cochin ...	170,124	93,546	76,578	188,516	88,513	100,003
Coorg ...	899	609	290	52,384	33,868	18,516
Bombay ...	22,747	11,271	11,476	238,070	159,567	78,503
Sourashtra ...	2,387	1,519	868	1,043	693	350
Kutch ...	888	451	437	303	263	40
Madhya Pradesh ...	5,758	3,908	1,850	16,949	8,900	8,049
Madhya Bharat ...	38	18	20	1,412	936	476
Hyderabad ...	93,083	44,999	48,084	129,455	64,121	65,334
Bhopal ...	...	...	...	204	45	159
Vindhya Pradesh ..	16	14	2	149	62	87
Rajasthan ...	6,223	4,436	1,787	1,008	566	442
Punjab ...	2,125	1,554	571	2,181	1,749	432
Himachal Pradesh & Bilaspur ...	7	5	2	5	1	4
Patiala & East Punjab States Union.	14	8	6	468	435	33
Jammu and Kashmir ...	161	146	15	...	...	...
Delhi ...	900	511	389	3,920	2,539	1,381
Ajmer ...	115	69	46	3,997	2,094	1,903
Andaman & Nicobar Islands ...	47	18	29	3,919	2,978	941
French and Portuguese Settlement ...	29,797	12,687	17,110	...	...	...
Total ...	473,452	237,921	235,531	1,300,218	724,640	575,578

Source : D-IV—migrants—pages 248–2€0, Part II-A. Demographic Tables, Census of India, 1951.

Three possible methods can be suggested for estimating the out-migrants in 1951 Census from the present Madras State :

Method-I

Let P, P^1 be the population in 1951 of the Madras State as constituted now and as it existed in 1951. Let M, M^1 be the out-migrants from Madras State as it exists now and as constituted then, M can be estimated thus :

$$M = M^1 \times \frac{P}{P^1}$$

The assumption involved here is that the ratio of out-migrants to the population of composite and present Madras State is the same.

Method-II

Let I, I^1 be the number of in-migrants to the present and composite Madras State and M, M^1 be the corresponding out-migrants. Then $M = M^1 \times \frac{I}{I^1}$.

Since I has been estimated and I^1 is available from the Census Reports, this method is also feasible. This involves the assumption that the ratio in regard to in-migrants will be the same as that of out-migrants.

Method-III

This method involves the assumption that migration takes place only from adjoining districts and involves the computation of a reduction factor for 'added areas'—areas included in the present Madras State as against the earlier area. The reduction factor is worked out by expressing the population of added areas as a ratio of the population of all the areas of the present Madras State adjoining the ceded area. The reduction factor may then be applied to the total migrants to the ceded area to get the out-migrants from the added area to the ceded area. This is explained below with an example.

TABLE III

Adjoining districts of Madras in North Madras Division

District		Population 1951	Added Population 1951
(1)		(2)	(3)
1. Cudappah	...	1,161,731	...
2. Kurnool	...	1,270,843	...
3. Chittoor	...	1,810,377	144,111
4. Chingleput	...	1,853,619	1,853,619
Total	...	6,096,570	1,997,730

The Reduction Factor is $\frac{1,997,730}{6,096,570} = .327681$. The above reduction factor is applied to the total migrants from these four districts to the North Madras Division to get the migrants from the added areas to the North Madras Division. The result is $76,480 \times .327681 = 25,061$. The above example explains the reduction factor approach.

We have adopted the first and third approaches in working out our migration estimate. The total out-migrants from the present Madras State area to other States in 1951 was estimated to be 519,039.

(c) In-migrants from each State

The method described earlier only gives the total quantum of in-migrants to the State in 1951 but not the actual number from each State. This can be obtained as follows. In pp. 166–176 of Table D-IV in Part-II of Madras 1951 Census Tables, the migrants from other States to each district is available and therefore the data for the districts constituting the present Madras State can be culled out and totalled. For the Nilgiris district which was classed along with Malabar and South Kanara districts in 1951, the figure given in Column (6) of Table 1.4 of Part-I-A Report, p. 46, may be given and Column (9) of this table will give the number of persons born in Andhra, Kerala & Mysore areas of composite Madras State. Adding these together, we have the migrants from other parts of Madras State to the districts of present Madras State (Vide Tables IV and V). We have presented the data as such. The major limitation is that the States sending migrants to Madras are in the form prior to reorganisation.

TABLE IV

Migrants Born in other States and Enumerated in Madras State, 1951

Born in	Enumerated in the district of													
	Madras	Chin-gle-put	North Arcot	South Arcot	Salem	Coim-batore	Nil-giris	Madurai	Tiru-chira-palli	Than-javur	Rama-natha-puram	Tiru-nel-veli	Kanya-kumari	State
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
						MALES								
(i) States adjacent to the State of Enumeration ...	23,091	2,904	2,580	1,053	4,674	12,894	15,073	5,351	2,057	1,533	2,356	4,923	...	78,489
Orissa	221	16	3	2	...	7	1	88	1	...	2	7	...	348
Hyderabad	2,842	260	189	36	29	61	79	99	58	55	14	17	...	3,739
Bombay	3,586	449	126	123	117	250	181	348	101	222	58	73	...	5,634
Mysore	6,242	785	1,636	249	3,780	2,797	8,414	348	568	260	232	82	...	25,393
Coorg	169	54	4	...	4	19	...	...	...	...	...	...	...	250
Travancore-Cochin	10,031	1,340	622	643	744	9,760	6,398	4,468	1,329	996	2,050	4,744	...	43,125
(ii) Other States	5,113	1,598	372	189	90	295	398	494	2,092	444	98	88	...	11,271
Assam	12	27	3	1	1	...	1	2	1	3	...	...	...	51
Bihar	88	43	1	...	...	8	7	3	...	...	3	3	...	156
Madhya Pradesh	378	45	20	21	6	16	11	322	1,815	27	34	3	...	2,698
Punjab	569	518	8	6	...	33	33	24	20	7	4	5	...	1,227
Uttar Pradesh	826	341	37	6	30	50	13	19	67	94	20	16	...	1,519
West Bengal	566	161	70	35	17	38	45	59	55	184	13	33	...	1,276

Jammu & Kashmir	48	82	3	...	...	3	...	5	...	...	...	...	...	141
Madhya Bharat	...	...	2	...	...	...	...	...	...	...	...	...	...	2
Patiala & East Punjab States Union	...	1	...	...	...	1	...	...	...	...	...	...	...	2
Rajasthan	1,725	307	181	110	21	78	277	17	89	96	17	6	...	2,924
Sourashtra	491	...	...	3	...	36	...	14	...	...	...	18	...	562
Vindhya Pradesh	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Ajmer	...	1	29	...	...	1	...	...	25	1	...	...	...	57
Bhopal	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bilaspur	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cooch-Behar	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Delhi	171	44	18	6	15	31	8	29	20	32	7	4	...	385
Himachal Pradesh	...	4	...	...	...	...	...	...	...	...	...	...	...	4
Kutch	234	22	...	...	...	...	2	...	...	...	...	...	...	258
Manipur	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Tripura	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Andaman and Nicobar Islands	5	1	...	...	...	...	1	...	...	...	...	...	...	7
(iii) Elsewhere in India	4,086	579	372	4,173	81	107	33	137	339	2,000	27	57	...	11,991
(iv) Born in Andhra, Kerala & Mysore areas of composite Madras State	45,264	5,919	3,153	1,632	1,608	22,412	16,467	3,148	6,004	5,291	4,093	941	...	115,932
Total	77,554	11,000	6,477	7,047	6,453	35,708	31,971	9,130	10,492	9,268	6,574	6,009	...	217,683

Note : Figures for items (i), (ii) and (iii) have been taken from Table D-IV in Part II-B of Madras Census Tables, 1951, pp. 166–176. Item (iv) is taken from Part-I Report Col. (9) of Table 1.4 p. 46. The figure in respect of Nilgiris district is taken from Col. (6) of the same table.

TABLE V

Migrants Born in other States and Enumerated in Madras State, 1951

Born in	Enumerated in the district of													
	Madras	Chin-gle-put	North Arcot	South Arcot	Salem	Coim-batore	Nil-giris	Madurai	Tiru-chira-palli	Than-javur	Rama-natha-puram	Tiru-nel-veli	Kanya-kumari	State
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
						FEMALES								
(i) States adjacent to the State of Enumeration ...	16,479	1,886	2,904	702	6,685	13,885	11,514	3,869	2,470	1,109	1,259	5,266	...	68,028
Orissa	235	3	3	...	9	3	2	10	...	5	...	1	...	271
Hyderabad	1,693	194	170	48	34	26	50	25	89	40	9	12	...	2,390
Bombay	3,948	243	85	75	65	203	161	156	118	128	21	54	...	5,257
Mysore	5,668	837	2,060	256	6,181	5,423	6,505	306	698	267	47	52	...	28,300
Coorg	34	9	1	...	4	10	...	5	1	3	1	...	...	68
Travancore-Cochin	4,901	600	585	323	392	8,220	4,796	3,367	1,564	666	1,181	5,147	...	31,742
(ii) Other States	3,131	500	304	182	171	174	353	228	241	502	28	41	...	5,855
Assam	97	5	1	...	...	...	1	1	...	...	...	1	...	106
Bihar	75	24	9	...	...	1	...	2	...	...	...	2	...	113
Madhya Pradesh	451	62	17	18	12	13	4	69	69	26	3	2	...	746
Punjab	177	92	4	3	11	36	18	26	38	1	1	3	...	410
Uttar Pradesh	496	39	51	10	48	32	40	4	39	85	3	5	...	852
West Bengal	521	55	71	16	21	17	38	33	55	305	5	12	...	1,149
Jammu & Kashmir	2	7	...	...	...	...	1	...	...	...	...	...	...	10

Madhya Bharat	...	1	...	...	...	...	...	...	...	...	...	...	...	1
Patiala & East Punjab States Union ...	4	...	...	...	...	...	...	...	...	...	...	...	...	4
Rajasthan	444	152	134	127	28	17	247	2	10	50	12	5	...	1,228
Sourashtra	466	...	...	2	...	35	...	80	...	...	...	9	...	592
Vindhya Pradesh	...	...	...	1	...	...	...	...	...	...	...	...	...	1
Ajmer	...	1	12	...	5	1	...	...	2	...	...	...	...	21
Bhopal	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Bilaspur	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Cooch-Behar	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Delhi	144	43	5	5	46	22	3	11	28	35	4	2	...	348
Himachal Pradesh	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Kutch	230	19	...	...	...	...	...	...	...	...	...	...	...	249
Manipur	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Tripura	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Andaman & Nicobar Islands ...	24	...	...	...	...	...	1	...	...	...	...	...	...	25
(iii) Elsewhere in India	3,509	681	441	7,756	72	98	17	124	805	3,083	29	16	...	16,631
(iv) Born in Andhra, Kerala & Mysore areas of composite Madras State	31,823	4,522	2,579	912	2,592	16,292	12,310	3,327	5,782	3,900	6,519	512	...	91,070
Total	54,942	7,589	6,228	9,552	9,520	30,449	24,194	7,548	9,298	8,594	7,835	5,835	...	181,584

Note : Figures for items (i), (ii) and (iii) have been taken from Table D-IV in Part II-B of the Madras Census Tables, 1951, pp. 166-176. Item (iv) is taken from Part I Report Col. (10) of Table 1.4 p. 46. The figure in respect of Nilgiris district is taken from Col. (7) of the same table.

1941

Migration data were not tabulated due to war.

1931

Birth place figures are furnished in respect of each district in the 1931 Census, Volume XIV, Imperial and Provincial Tables, Table VI. The figures are available for the following categories :

(1) Migrants born in other districts of the Presidency.

(2) Migrants born in Provinces and States beyond the State of enumeration.

(3) Migrants born in foreign countries.

(*a*) To estimate the in-migrants from other States

By adding up items A-I (*b*)—Madras State, A-II—Born in Provinces & States beyond the Presidency, and A-III—India unspecified, from Table-VI for the districts of the present Madras State excluding Kanyakumari, we get the total migrants from other States (as they existed then) to these districts. For Kanyakumari district, a pro-rata estimate can be made and added. To this we will have to add an estimate of the migrants from Andhra districts to these districts.

(*b*) To estimate the out-migrants to other States

The number of persons born in composite Madras State and enumerated in other States is available in Subsidiary Table II, 1931, Vol. I—India, Part I, Report by J. M. Hutton. The only possible method of estimation for the present Madras State is to assume that the ratio of out-migrants from the composite Madras State will be true to the present Madras State and pro-rate the data.

TABLE VI

Emigrants to Andhra, Kerala and Mysore Districts of the composite Madras State from the present Madras State, 1921

Born in	Emigrants to Andhra Districts		Kerala Districts		Bellary and South Canara Districts	
	Males	Females	Males	Females	Males	Females
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Madras ...	6,421	4,109	265	226	5,648	3,669
Chingleput ...	5,362	5,625	21	11	134	113
North Arcot ...	6,651	6,667	75	28	313	185
South Arcot ...	1,959	1,181	71	28	63	20
Salem ...	1,522	1,726	209	203	501	97
Coimbatore ...	657	589	2,257	1,906	152	77
Nilgiris ...	35	30	162	180	68	50
Madurai ...	479	530	172	81	74	73
Tiruchirapalli ...	790	722	163	141	161	147
Thanjavur ...	1,330	1,102	195	183	170	109
Ramanathapuram ...	82	60	26	12	18	6
Tirunelveli ...	460	287	240	92	105	16
Kanyakumari ...	...	...	...	...	...	...
State ...	25,748	22,628	3,856	3,091	7,407	4,562

1921

(*a*) In-migrants

Persons born in other States and enumerated in different districts of Madras State are available in Table-XI, Part-I, p. 90 of Imperial & Provincial Tables, 1921 Census. Persons born in each district and enumerated in each of the other districts of the former State are given in Part-I of Table XI of 1921 Census Imperial Tables. From this, the number of persons born in the districts of Andhra, Kerala and Mysore States are worked out for the districts of the present Madras State excluding Kanyakumari. For Kanyakumari, pro-rata figures may be worked out. Added together, we get the total in-migrants to the present Madras State in 1921.

(*b*) Out-migrants

The figures in respect of out-migrants to Andhra, Kerala and Mysore districts of the former Madras State are worked out from Table XI, Part I of 1921 Census, Provincial and Imperial Tables. The number of migrants to other States from the present Madras State cannot be worked out directly as the data are not tabulated according to the district of origin. The only method open to us is to work out the migrants from the composite Madras State to other States and pro-rate the data for the present Madras State.

1901 & 1911

The number of in and out-migrants to the composite Madras State as available in Subsidiary Table VI, Census of India, 1911, Vol. I, India, Part I, Report by E. A. Gait, p. 104 have been compiled and a method of adjusting the data for the present Madras State is yet to be arrived at.

We have presented the data collected for 1901 to 1931 in Table IX and we have not attempted their adjustment for present Madras State. This is a large problem by itself and will require further investigation.

TABLE VII

Inter-State Migration—Persons born in other States and enumerated in Madras State, Birth Place Data, 1921

States in which born	Enumerated in the district of													
	Madras	Chin-gleput	North Arcot	South Arcot	Salem	Coim-batore	Nil-giris	Madurai	Tiru-chira-palli	Than-javur	Rama-natha-puram	Tirunel-veli	Kanya-kumari	State
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
						MALES								
1.1 Andhra Districts	11,017	10,274	5,110	757	453	797	540	327	385	494	451	67	...	30,672
1.2 Hyderabad	1,400	274	232	71	6	36	152	16	53	38	8	10	...	2,296
1. Andhra	**12,417**	**10,548**	**5,342**	**828**	**459**	**833**	**692**	**343**	**438**	**532**	**459**	**77**	...	**32,968**
2. Bengal	984	50	26	25	5	24	81	8	...	180	23	83	...	1,489
3. Bihar & Orissa	41	21	...	2	...	...	...	...	1	2	1	...	...	68
4. Uttar Pradesh	337	...	190	10	...	...	62	11	9	50	164	8	...	841
5. Bombay	1,398	141	95	84	15	117	161	47	122	121	126	44	...	2,471
6. Madhya Pradesh	661	81	131	12	60	71	90	7	23	9	1	3	...	1,149
7.1 Mysore & Coorg	2,278	533	1,746	120	2,603	1,807	4,902	142	338	254	87	19	...	14,829
7.2 Bellary & South Canara	1,537	201	170	56	29	446	211	117	122	127	34	63	...	3,113
7. Mysore	**3,815**	**734**	**1,916**	**176**	**2,632**	**2,253**	**5,113**	**259**	**460**	**381**	**121**	**82**	...	**17,942**
8. Kerala	5,570	690	694	585	693	7,000	4,897	1,347	1,412	2,076	1,096	1,361	...	27,421
9. Other States	2,418	716	49	2,568	27	94	198	132	203	1,282	28	26	...	7,741
All States ...	27,641	12,981	8,443	4,290	3,891	10,392	11,294	2,154	2,668	4,633	2,019	1,684	...	92,090

FEMALES

1.1 Andhra Districts ...	...	8,117	10,101	3,877	745	376	113	379	127	233	299	211	26	...	24,604
1.2 Hyderabad ...	...	933	186	149	58	17	26	94	15	50	27	6	13	...	1,574
1. Andhra ...	...	**9,050**	**10,287**	**4,026**	**803**	**393**	**139**	**473**	**142**	**283**	**326**	**217**	**39**	...	**26,178**
2. Bengal ...	...	213	54	7	5	4	12	43	19	18	22	1	7	...	405
3. Bihar & Orissa ...	...	17	25	...	2	...	...	...	...	...	2	...	...	...	46
4. Uttar Pradesh ...	...	188	...	159	9	...	1	19	5	5	15	32	5	...	438
5. Bombay ...	...	1,106	103	39	55	5	81	171	51	40	74	15	12	...	1,752
6. Madhya Pradesh ...	...	320	80	118	6	30	61	41	...	...	20	15	1	...	692
7.1 Mysore & Coorg ...	...	2,203	642	2,172	110	3,569	2,580	3,563	100	600	202	40	20	...	15,801
7.2 Bellary & South Canara ...	...	989	94	129	42	27	224	173	14	71	58	9	35	...	1,865
7. Mysore ...	...	**3,192**	**736**	**2,301**	**152**	**3,596**	**2,804**	**3,736**	**114**	**671**	**260**	**49**	**55**	...	**17,666**
8. Kerala ...	...	2,210	290	316	250	346	2,724	2,055	884	1,024	1,039	406	954	...	12,498
9. Other States ...	...	1,525	715	55	3,461	35	61	177	115	305	1,695	16	12	...	8,172
All States ...	...	17,821	12,290	7,021	4,743	4,409	5,883	6,715	1,330	2,346	3,453	751	1,085	...	67,847

TABLE VIII

Inter-State Migration—Migrants to Madras State from other States, 1921

District		Migrants		Population according to 1921 Census		Population as adjusted to present boundaries		Correction Factors		Estimated Migrants		
		Males	Females	Males	Females	Males	Females	Males	Females	Persons	Males	Females
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Madras	...	27,641	17,821	276,107	250,804	309,466	282,070	1.12082	1.12466	51,024	30,981	20,043
Chinglcput	...	12,981	12,290	752,542	740,516	758,471	748,044	1.00788	1.01017	25,498	13,083	12,415
North Arcot	...	8,443	7,021	1,021,087	1,034,507	1,008,548	1,022,094	0.98772	0.98800	15,276	8,339	6,937
South Arcot	...	4,290	4,743	1,152,414	1,167,671	1,152,414	1,167,671	1.00000	1.00000	9,033	4,290	4,743
Salem	...	3,891	4,409	1,051,025	1,061,009	1,060,495	1,070,505	11.00901	1.00895	8,374	3,926	4,448
Coimbatore	...	10,392	5,883	1,106,171	1,113,677	1,046,597	1,054,130	0.94614	0.94653	15,400	9,832	5,568
Nilgiris	...	11,294	6,715	67,018	59,501	67,018	59,501	1.00000	1.00000	18,009	11,294	6,715
Madurai	...	2,154	1,330	987,468	1,019,614	982,391	1,014,346	0.99486	0.99483	3,466	2,143	1,323
Tiruchirapalli	...	2,668	2,346	931,890	970,948	1,136,902	1,192,705	1.22000	1.22839	6,137	3,255	2,882
Thanjavur	...	4,633	3,453	1,116,702	1,209,563	1,118,455	1,211,504	1.00157	1.00160	8,099	4,640	3,459
Ramanathapuram	...	2,019	751	818,619	903,218	822,375	906,978	1.00459	1.00416	2,782	2,028	754
Tirunelveli	...	1,684	1,085	926,515	974,881	946,968	994,745	1.02208	1.02038	2,828	1,721	1,107
Kanyakumari	...	...	...	...	...	249,389	244,736	0.02443*	0.02330*	3,830	2,250	1,580
State	...	92,090	67,847	10,207,558	10,505,909	10,659,489	10,969,029	...	...	169,756	97,782	71,974

* Based on the ratio (Kanyakumari district ÷ rest of the State as on 1921).

TABLE IX

Estimated net Migrants to composite Madras State, 1901 to 1931, Birth Place Data

State	1901			1911			1921			1931		
	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Ajmer-Merwara ...	35	...	35	120	...	120	445	...	445	...	...	...
Andaman & Nicobar ...	38	...	38	65	...	65	2	...	2	...	...	...
Assam ...	153	21,571	—21,418	204	34,519	—34,315	51	54,536	—54,485	...	57,469	—57,469
Baluchistan ...	23	...	23	126	...	126	147	...	147	...	...	...
Bengal ...	9,720	27,702	—17,982	6,547	14,241	—7,694	3,181	31,270	—28,089	...	42,489	—42,489
Bihar and Orissa ...	...	...	...	1,401	35,489	—34,088	16,879	35,933	—19,054	...	40,786	—40,786
Bombay including Aden ...	24,428	32,384	—7,956	18,822	35,484	—16,662	17,806	45,592	—27,786	...	60,199	—60,199
Western India States Agency ...	...	...	...	...	...	...	...	...	...	...	381	—381
Burma ...	1,502	189,828	—188,326	2,021	248,064	—246,043	1,915	272,565	—270,650	3,181	297,633	—294,452
Central Province & Berar ...	14,071	22,463	—8,392	7,206	10,220	—3,014	12,529	6,505	6,024	...	13,045*	—13,045
Coorg ...	631	...	631	741	...	741	345	...	345	...	...	...
Delhi ...	...	...	...	...	...	...	216	553	—337	...	1,446	—1,446
N.W.F.P. ...	1,044	937	107	82	72	10	146	1,959	—1,813	...	776	—776
Punjab (including Agency) ...	...	...	...	875	1,089	—214	625	1,583	—958	...	1,601	—1,601
Uttar Pradesh (United Province) ...	3,272	1,606	1,666	2,105	2,290	—185	2,244	2,220	24	...	3,099	—3,099
Baroda State ...	304	208	96	320	228	92	130	264	—134	...	555	—555
Central India Agency ...	479	1,026	—547	503	1,033	—530	...	498	—498	...	736*	—736

TABLE IX—(*Contd.*)

Estimated net Migrants to composite Madras State, 1901 to 1931, Birth Place Data—(*Contd.*)

State	1901			1911			1921			1931		
	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants	Born in State specified in Col. (1) & enumerated in Madras	Born in Madras & enumerated in specified State	Net Migrants
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Cochin State ...	7,078	33,201	—26,123	9,643	30,488	—20,845	10,124	26,388	—16,264	14,820	54,623	—39,803
Gwalior State ...	...	...	...	...	...	...	15	52	—37	...	85	—85
Hyderabad State ...	62,386	55,369	7,017	60,692	67,821	—7,129	38,916	84,149	—45,233	58,476	132,954	—74,478
Jammu & Kashmir ...	32	9	23	28	27	1	33	34	—1	...	33	—33
Mysore State ...	89,430	255,152	—165,722	92,732	263,417	—170,685	66,855	267,305	—200,450	86,485	294,117	—207,632
Rajaputana Agency ...	1,488	177	1,311	1,491	290	1,201	1,415	212	1,203	...	259	—259
Sikkim State ...	...	...	...	...	...	...	...	...	...	...	...	...
Travancore State ...	8,966	40,524	—31,558	10,446	49,520	—39,074	8,293	58,277	—49,984	16,756	104,342	—87,586
India Unspecified ...	284	31,046	—30,762	386	30,431	—30,045	40	24,897	—24,857	51,162	28,603*	22,559
French & Portuguese Settlement ...	20,473	...	20,473	22,174	...	22,174	14,257	...	14,257	16,012	...	16,012
Outside India ...	12,975	...	12,975	15,147	...	15,147	13,253	...	13,253	20,303	...	20,303
Total ...	258,812	713,203	—454,391	253,877	824,723	—570,846	209,862	914,792	—704,930	267,195	1,135,231	—868,036

* Includes figures for Cochin & Travancore.

Source : Figures for 1901 and 1911 obtained from Subsidiary Table VI, Census of India, 1911, Vol. I, India, Part I, Report by E. A. Gait.
Figures for 1921 and 1931 obtained from Subsidiary Table II, Census of India, 1931, Vol. I, India, Part I, Report by J. M. Hutton.